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Psychological Review

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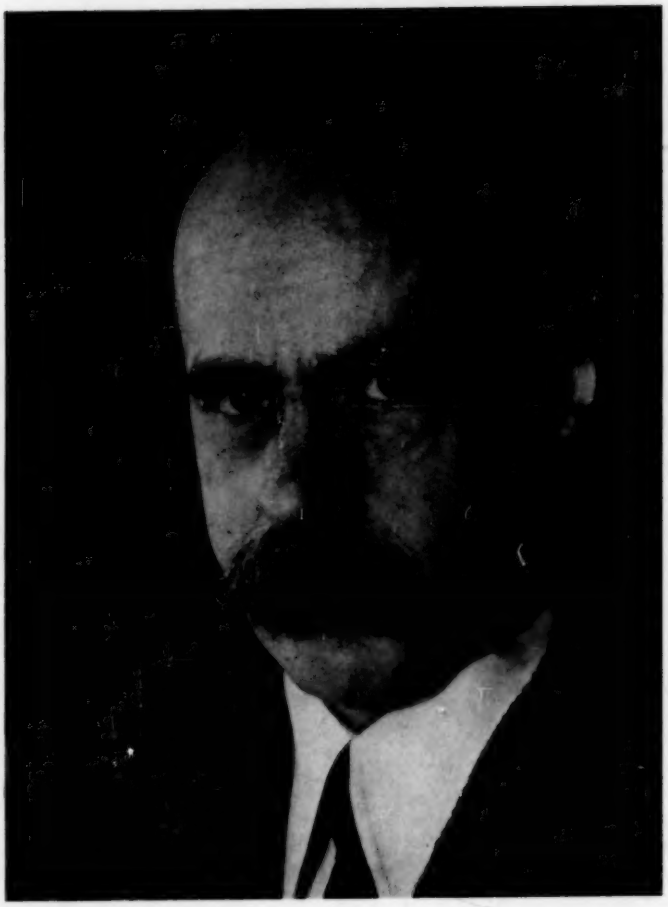

Max Wertheimer

VOL. 51, NO. 3 MAY, 1944

THE PSYCHOLOGICAL REVIEW

MAX WERTHEIMER

1880–1943

It is beyond my power to describe Max Wertheimer as a person. Nor would he want me now to consider the course of his life. But he saw with disappointment that in this country his name was connected with details of perception while his main contribution to human thought was looked upon with distrust. I will therefore try to clarify this contribution.

Toward the end of the nineteenth century William James and others expressed serious doubts as to the adequacy of the course which psychology had taken. Between the work that was being done in the laboratories and the actual spectacle of human life they sensed a gap which no further efforts along the same lines would be able to bridge. They also observed that it was probably the analytical procedure of academic psychology which somehow caused the trouble. But the critics knew of no working principle which could replace the analysis of given facts into simpler components. The first to discover such a principle was Max Wertheimer.

Science, he observed, deals with facts and situations of two different kinds. A first type may rightly be regarded as consisting of components which are mutually independent. Analysis in the customary sense is here an adequate procedure. But there are situations of a second type. A situation of this type does not consist of components in the sense in which this is true of the former type. For its parts exhibit characteristics which they owe to their position within the larger entity. Analysis in the usual meaning of the word is thus not applicable; it would falsify the given data. Outside their particular situation the parts in question would not remain what they were within it. With an expression which Wertheimer liked to use: Situations of the first type allow of an interpretation 'from below,' an interpretation that starts with components, joins such components, and then arrives at the situations themselves. In situations of the second type this procedure is inadmissible. They have to be interpreted 'from above'; because with this type it is a situation as a whole which determines the behavior of its parts.

This distinction makes it clear why William James and other critics could not be satisfied by the psychology of the laboratory. At that time psychology took it tacitly for granted that the approach 'from below' is the only approach of which science can approve. But facts which can be so treated always have the character of accidents, and are devoid of sense. Let all the components of such a fact be strictly determined by their causes. Then, since each component is independent of the others, it still appears as an accident that just these components are thrown together in one situation. And in an accidental combination there is no place for sense. The critics rightly objected to a psy-

chology which in this fashion excluded sense as a matter of principle. They were aware that feelings spring from the nature of their objects, that answers refer to the contents of questions, and that actions correspond to the trends of given motivations; in other words, that all the major facts of mental life are imbued with sense. Could psychology be on the right track if it ignored this?

Some time between 1910 and 1912 Wertheimer realized that the difficulty disappears as soon as such mental events are interpreted 'from above.' Interpretation 'from above' is the methodological counterpart of *determination* 'from above' within the given facts. And in psychology determination of this kind is particularly obvious wherever we are dealing with sense. It is a remarkable fact that psychological causation which determines the rôle of parts within a larger structure tends to be felt as 'following from,' not simply as 'following.' And 'following from' is the principal characteristic of understandable relationships, *i.e.*, of sense.

When a person is proud of an achievement his affective state is not a component of the situation but a temporary characteristic of his self which derives from the larger situation. And since he feels his reaction to be sensible under such conditions, psychological causation here means 'following from.' Nowhere is the same fact more obvious than in motivation, which offers innumerable instances of determination 'from above.' I quote from Woodworth: "What you are doing in toto determines what you do piecemeal. If anyone asks you why you are doing this [detail], your answer is, 'Because I am doing that [total act].'" But even in the simplest motivation, in which we cannot distinguish between a total act and a merely instrumental act of detail, an object has the character of a goal only with reference to a larger mental structure which gives it that character.

It may seem surprising that for years Wertheimer never mentioned motivation when he discussed determination 'from above.' The reason is that motivation is generally believed to concern only the subjective interests of individual selves, and Wertheimer was forever suspicious of mere selves. He despised that little voice which keeps whispering: Where do I get my share? Nothing would have appeared to him more unfortunate than the assumption that things make sense only with reference to the subjective wishes of an I. He admitted no necessary connection between the general concept of determination 'from above' and the particular demands of a self. Thus he turned away from problems of motivation. Later, he thought, when fundamentals were clear, subjective motivation would be more readily recognized as what it is: not the essence of the new principle but a special instance to which it also applies.

There was less danger of subjectivistic misinterpretations in such fields as perception and thought. On these Wertheimer concentrated his whole energy, and he never tired of demonstrating to himself and to his students that the same basic concepts apply to both topics. They had to, because in both he found the principle of determination 'from above' at work. About thinking Wertheimer has written a book which, as his friends know, was completed in a ceaseless struggle with a foreign language and ever-growing exhaustion. When it is published it will speak far better in his memory than anything I can now say. It will also convince the reader that the vectors which determine parts within larger structures need not at all issue from the self. In mathematical thought, for instance, the proof of a thesis begins with the emergence of a scheme which reaches

as a unit from the given premises to the thesis. The scheme then generates a number of specific links, and the complete chain of these links becomes the actual proof. This is again determination 'from above.' The way in which the specific links develop from the scheme is also felt to be thoroughly sensible. And yet in this there is no reference to subjective interests of the self. It is purely objective sense which here determines parts when the larger scheme is given.

It is from this point of view that we can best understand Wertheimer's theory of perception. A perceptual field, he said, is again a situation in which the characteristics of parts derive from larger structures. Thus black on white at one point and in one structure becomes a corner, a similar black at another point and in another structure a center. But even the sensory qualities of traditional psychology may be strongly modified by the pressure of the structures in which they lie. Under Wertheimer's guidance Benary showed this in the case of contrast colors, and Fuchs for colors in general. Similarly, lines turn or bend, and distances grow or shrink, as they yield to the intrinsic forces of a configuration.

In Wertheimer's view percepts are like organisms. The shortness of their lives does not prevent them from being highly particular about their own structure. The vector field in their interior shifts and moulds their parts in the direction of an optimal state. Many have been disturbed by the supreme unconcern with which Wertheimer spoke of perception as though it were imbued with value. Did he not freely use the expression *gute Gestalten?* Surely, he did not merely imply that certain perceptual entities appeal more to the self than do others. They may or they may not do so. What he had in mind were particular or unique configurations *per se,* configurations in which a maximum of balance is actually reached so that no local change could further improve it. In the same fashion he regarded a *part* as good or fitting if it agreed with the dynamic trend of its whole configuration. And he used the term 'good' in order to indicate that the dynamics of perception are fundamentally the same as those of motivation and of thought. In these fields nobody can avoid the use of such words as fitting or good, and bad or wrong. They invariably obtrude themselves as adequate expressions when the position and the characteristics of a part agree, or disagree, with the trend of the vector field in a larger situation. Now, this happens just as often and as clearly in perception as it does in thinking and in the motivation of our actions. Those terms have, therefore, no less a legitimate application in the former field than they have in the latter. By now it will be generally recognized that a psychology which nowhere refers to requiredness or value is hardly worth its name. But to decide how far the realm of requiredness extends in psychology is entirely a task of observation. And Wertheimer held that those who try to exclude value from the field of perception merely refuse to face facts. After all, when referring to *gute Gestalten* and their fitting parts we only acknowledge that the subject matter of aesthetics on its most elementary level is perception; and aesthetics deals with value. It is quite true sensory dynamics as observed in perception is likely to be congruent with the dynamics of functional structures in the brain. Thus it might appear that causation within such functional structures can also be described in terms of 'following from.' And this would disturb the scientists. But if such should be the great secret of nature, whom are we to follow, nature or the scientists?

At times Max Wertheimer was a pro-

foundly happy man. The implications of his view then filled him with a bliss which those who have found a religion may best understand. At other times he was grievously disturbed by the fact that his discoveries had to be formulated in writing if they were to convince an often frankly hostile scientific public. For this purpose he had to use ordinary language, a means of communication which, whether German or English, almost refused to express what he so urgently wanted to say. Modern languages are adapted to the practical behavior of common things in our everyday environment. For our practical purposes this behavior mostly allows of description 'from below.' Things can be placed in virtually any arbitrary arrangements; and, again practically, they are not greatly altered by the process. This fact has left its imprint not only on our thought but also on our language so that *both* tend to approach everything 'from below.' Wertheimer would not have worried about hostile thought. He could be a cheerful fighter. But it was his despair that the fighting had to be done in words in which the preconceptions of his opponents were firmly embodied. When he tried to use these treacherous tools and yet at the same time not betray his best convictions he often suffered bitter frustration.

For this reason what we so far have from him in print can give no adequate impression of his extraordinary mind. It was only in lectures and in discussions that he forgot to worry about the pitfalls of language. Then sceptics and friends alike would be swept along by his thought as though by a torrent. Whoever has heard him on such occasions knows that psychology has lost one of its great pioneers. An American psychologist once told me that if he had listened only to one particular lecture of Wertheimer's in Berlin, the one experience would have been ample compensation for a long dreary winter in Germany. And that exciting lecture explained what just noticeable differences are in terms of Gestalt theory!

When confronted with a perfectly new situation Wertheimer always had an incisive question to ask when we others were still merely bewildered. Old problems he often turned upside down, whereupon facts suddenly shone in the light of unexpected solutions. And all the while there was never any doubt: With all his force, in his great simplicity and devotion he resembled Saint Francis. Max Wertheimer was an unusually good man.

WOLFGANG KÖHLER

Swarthmore College

VIOLENCE WITHIN THE NATION; TREATMENT, PARTICULARLY IN THE UNITED STATES

BY GEORGE MALCOLM STRATTON

University of California

Men, by a paradox, are at once the most quarrelsome and the most coöperative of all creatures. In both of these forms of action, human beings display an ingenuity and power and tenacity of purpose that quite out-top what is done by bees or ants, by wolves or tigers, by elephants or apes.

In an earlier study,[1] the cause of violence was sought by a procedure not usual. An array of evidence indicated that individuals and bodies of men, if united by the psychic and other ties of an organized community, infrequently come to blows with one another, but usually work together without this serious interruption. If, however, they lack such ties, their coöperation is fragile indeed and their dealings lead soon or late to violent conflict. This finding, it was felt, bears importantly on international practice. For only by strengthening such ties as now exist between nations and thus creating a community overspanning them, can they be freed from recurring warfare. Various particulars, it was pointed out—racial, economic, political, and more—might precipitate or delay the recurrence. But outweighing these was the absence or presence of the bonds of fellow-membership in a greater body. Such was the kernel of the study that went before.

The present study is concerned with the natural source of violence and cooperation; with the dynamic process, mainly psychic, by which they are profoundly altered; and with the bearing of all this on our scientific view and on our practice in the nation's domestic life.

I. Violence and Coöperation, and Our Natural Constitution

Is violence very bone of our bone, while coöperation is hardly skin deep? The answer will seriously affect both our social outlook and our behavior. May we, then, seek the evidence and the direction of its pointing.

In the wide variety of acts of animals and children, there plainly appear rudiments of *both* these forms of behavior. Young pups of a litter which the writer carefully observed day after day, both quarreled and played together. Keeping fairly close to their mother and one another, they scampered about, chasing and being chased, nipping and being nipped, appearing to be in joyous spirits. The play involved an intricate accommodation of one's action to another's; the quick movements of the pups were brought into a pattern wherein were instinctive running and instinctive biting, the whole worked out with exuberant energy, with enjoyment in the activity itself, and in the excitement from an adventure in giving and avoiding a slight pain, and in having all this in the company of one's familiars. The mother was in the midst but in no wise led or directed the play; she dozed with muzzle on fore paws, and waked only long enough to snap not too seriously at any of her brood that included her in the nipping part of the game. There seems good ground for regarding the social activity of the puppies as untaught, as a spontaneous form of fellow-action, of coöperation.

[1] Violence between nations; deeper sources; the way of liberation, Psychol. Rev., 1944, 51, 85–101.

But violence was always just around the corner. For often in the excitement, the inhibitions of play were relaxed, the needle-like teeth went a bit too deep, the sufferer retaliated, and for a moment the pair of pups were at the serious business of intentional hurt.

Children likewise display such beginnings. For a while a pair may act in friendly concert. Suddenly one of them grabs what the other holds; and now comes outcry and muscular contention. There seems no sound reason for ascribing the friendly collaboration to learning, while ascribing to nature the violent assertion of purpose against purpose. Both forms alike seem natural, even though both alike are elicited only by a situation suited to call them forth—even as sensations of red and green are equally provided for in our native constitution, and yet arise in us only when externals act suitably on the retina of the eye.

For our present interest, however, more should be said than that both violence and coöperation alike are natural. It is of moment that the natural provision for violence and coöperation leaves many an important feature of them quite undetermined, quite open to a shaping by circumstance, knowledge, and choice. Some of the features thus left open should be named.

Our nature leaves undetermined the special acts by which our two kinds of impulse shall be carried out: our violence, by movements ranging from kick and bite to a skilled use of knife, rifle, or machine-gun; our coöperation, by movements ranging from swing of axe, or grip on plow, to dictating a letter, or watching the sky for airplanes.

Undetermined by our nature, too, is what we shall be *violent about*, about a toy grabbed, or an insulting word, or the invasion of our nation's territory; and what we shall *coöperate in*, whether it shall be in pillage, or in house-building, or in international defense and justice.

Our nature leaves undecided also the particular individuals and bodies of men against whom we shall aim our blows—be it Smith or Jones, labor union or employers' organization, France or Germany,—and with which of these and others we will join in friendly action.

Our nature leaves undecided, further, the frequency of our violence, of our coöperation, so that blows may be struck less often or more often, while collaboration may become more or become less constant.

And finally our human nature leaves unprescribed the number or range of persons against whom our hand shall be raised—whether many or few—, and with whom we shall join hands in work —whether few or many. All told, then, our natural readiness to act violently or coöperatively leaves these activities malleable, ready to be shaped and finished in highly important ways; thus they are immeasurably more responsive to social needs and purposes than are such reflexes as coughing, sneezing, and knee-jerk. We should at once see something of the extent to which they are actually taken in hand and shaped for social life.

II. THE DYNAMIC PROCESS OF RECLAIMING HUMAN CONDUCT

Neither coöperation nor violence, in its natural display, is quite acceptable to family, tribe, or nation. Such a life in common requires that individuals work together more systematically and for more varied and widely approved ends, than when left to natural impulse. And of violence among fellow-members, there is need that it be less frequent, less explosive and damaging, and less indiscriminate, more reserved for the common enemy, than it would be by natural impulse. In the nation there must be coöperation in a thousand selected ways —for food, clothing, and shelter, for

roads and transport, for production and trade, for health and education, for morals and government. Violence obstructs all this. The baker bakes less and poorer bread if hourly he must be on guard against attack from his helper or his rival up the way. The common life thus requires, in general, that cooperation be steadied, extended, diversified, rightly aimed; and that violence be prevented from disrupting or impeding seriously this work for benefits to be shared.

The dynamic process, to meet this need, has its many human agents, working singly, working together, in numberless ways.

The process usually begins in infancy, with the mother's express disapproval—when she feeds, bathes, clothes, or puts to sleep her child—of the child's insistence on having his own will in the matter, by push, pull, kick, and scream. Both punishment and reward, physical and psychic, are meted out.

The punitive measures include bodily restraint, mild pain, the withholding of small pleasures. Unflattering words and looks are used, along with ridicule. With most of us, social condemnation, pure or applied, is a strong deterrent. The child rarely experiences save unpleasantly his exclusion from social play or other companionable doings, administered by those annoyed at his violent self-will. Most youths or adults also suffer in some degree when their bullying or other rowdy ways are found to restrict seriously their choice of companions, mate, and employment. And if one persists he may suffer publicly a dire form of restriction on movement and fellowship, that of imprisonment or death. Such are some of the repressive features of the dynamic process.

Rewards, as a part of the dynamic process, are likewise present to foster beneficent coöperation: Year in, year out, the scales are hedonically weighted physically and psychically by the community, on the side of such fellow-working. To the young child rewards of many kinds come in the train of acts consonant with the family's way of life, with household order. In this he feels the favoring attitude of parent, brother and sister, pleasurable to him; their words and looks encourage him. So it is also in his play with others, in and beyond the family. And as he comes toward manhood he is led to prepare himself for an occupation in connection with other men that benefits both them and himself, whereby he finds himself in more agreeable physical and social surroundings than usually come to one who will work with none. Reward thus joins with punishment, to make him less violent, more coöperative, in not only his outer *acts*, but in his inner *preference* for such acts, and for such knowledge and skill as make them possible.

But not only by punishment and reward does the dynamic process operate. The community presents patterns of conduct which by their frequency and by a prestige of those so conducting themselves are suggestive, are imitated —unintentionally often—by the apprentice member. Admonition, admiration, the subtly contagious attitude of others are channels of the process. One's occupation and one's companions in it are a great school of suggestion. And the suggestions are made the more effective by formulation in memorable words behind which grow principles of action and a texture of ideas held in honor by the individual. Particular acts thus acquire an enlarged meaning, and their pattern becomes applicable to a wide range of situations. And thereby the training or learning is made ready to 'spread,' to be 'transferred' into a wide field of human relations that involve hindrance or assistance to the common way of life.

Nor has the process a one-way direction—something done by one to another; rather, it is a joint affair: the child, the youth, the adult, takes part in his own reclaiming. Only if he collaborates in the process is there much fruit. The collaboration is more than going through the motions; it is deeper, characteristically psychic. Step by step he is led to accept the behavior, the inhibition, as fitting, as in accord with the reality and worth of the circle upon circle of his widening community—of his family, his friends and neighbors, his town or countryside, his state, his nation—a community of many communities. He can and often does resist all this, and then the process is without due effect.

As to the *result* of this Dynamic Process, both success and failure attend it; but far more of success than of failure.

Of its success—by the time the oncoming members of the community are 16 to 20 years old, nearly all of them have ceased or markedly reduced their violence, and have entered into coöperation of many kinds. There remain among them, now and always, ample differences of opinion, ample cross purposes, often even anger and hatred. But if we take the entire population, the adults lastingly non-violent and coöperative toward fellow members out-number by far those who persist in resort to onslaught. The success thus is large indeed.

The forms of restraint and of liberation thus created are, at first, external merely, but do not remain so. In general the youth comes actually to *like* much of the conduct that in his early years was imposed upon him, and actually to *dislike* much of what he earlier had practiced pleasurably, and from which he had refrained only because it led to punishment. Likes and dislikes, approval and disapproval, have become part of his attitude toward conduct, at first in others, then later in himself. He still may grumble and begrudge, and yet deeper in him are the forces that make the common attitude his own as well. In and about all this, there comes to be loyalty to his community of communities, to the nation itself and to the common culture with its standards of conduct. He may not make his own, all that is in a full loyalty to family, friends, truth, justice, country, and religion. But much of this becomes his; he often holds to them at least as standards for appraising men. And even when his own conduct falls far short of these inner standards of his, he still is at least unviolent, and is an orderly worker with others. By tens of millions have men been won away thus far from their natural wildness.

And now of the process as a whole, what it is not and is.

1. It is more than a process of natural growth, of natural maturing. The scanty knowledge we have of jungle children—children early and long without any human contact or training—indicates a result not at all like that of reclamation.[2]

2. It is more than an adaptation to the physical environment, so important in both human and animal evolution. Rather is it that men, to a degree not found among animals, lay hands on many a feature of nature, both physical and psychic, and adapt these to desires within themselves. The reclamation of men from their own wildness is a part of this re-shaping of what is natural. Certain natural powers in our constitution are turned upon other of our pow-

[2] Reasons for this conclusion may be found in the writer's *International delusions*, New York: Houghton, Mifflin, 1936, Chap. 3, and notes, pp. 223 ff. Further evidence is given in J. A. L. Sing & R. M. Zingg, *Wolf children and feral man*, New York & London: Harper & Brothers, 1942.

ers, to give them a more acceptable way of action.

3. The process is more than an indiscriminate opposition to the use of force, and an indiscriminate favoring of cooperation of any kind. It distinguishes, chooses. It allows force to be used by the community against the enemies of the community, whether they be within or without the walls. And it condemns and represses even coöperation when this clearly and seriously injures the community.

4. The process is more than the force of culture, as meant in anthropology. It adds to this force and subtracts from it, by forces peculiar to the individual, his family, his occupation, and beyond, forces which assist, nullify, or re-shape and recreate, from what is offered by culture generally.

5. The process is variously constituted in different societies: composed here to facilitate the private use of force in certain circumstances—to avenge, or to cleanse one's stained honor, or to obtain the rights of one's occupational group, while shaped elsewhere to inhibit all this.

6. Even in the individual the process may work in streaks, humanizing certain levels in him, and leaving other levels wild. Some soldiers of the Foreign Legion freely risked death to bring in a wounded comrade, only to pick his pockets as they bore him in. It pains the police, in *The Pirates of Penzance,* to arrest erring men who otherwise are so amiable. For, they sing,

When the enterprising burglar's not a-burgling—
Not a-burgling,
When the cut-throat isn't occupied in crime—
'Pied in crime,
He loves to hear the little brook a-gurgling—
Brook a-gurgling,
And listen to the merry village chime.

7. Reclamation, as considered in this paper, is concerned with two fundamental forces in the individual and the community, with violence and with cooperation. But actually few communities or none are content with so limited a reclamation, but would change their incoming members further, giving them language, habits undisgusting to their fellows, goodwill to many of their company, and some degree of loyalty to their community as a whole. The dynamic process of our present study is thus but a fragment of the full real process.

III. Areas Wherein the Dynamic Process Fails; Reasons for This Failure

The failures in reclamation should now be reviewed, to see where and why the usual result is wanting. In each area there will be found peculiar features, and yet along with them, one important feature will appear common to all the areas.

Children and those in early youth not infrequently use what force they can muster in support of self-will. Fatigue, sickness, unaccepted repression, unwise parental indulgence, the fact that the one toy cannot be monopolized by each of two children at the same time, and a score of other things contribute to this behavior. But with them all is this: that the dynamic process which later will have redirected all their magnificent self-expression, has not as yet had time to do its work. Its effect is gradual; the child's conduct yields to its power only through years.

With *delinquent youths* the time which with others has beneficent results has no such outcome. Poverty, sickness, ignorance, vice, or death, in the household may have contributed to make it no home. Or the neighborhood may have played a part, or an exceptional neuro-psychic constitution of the

child itself [8]—such factors help to explain, not in themselves but in that they have insulated the child from the reclamational forces in the community. Those in psychic contact with him have proved poor conductors of these forces, or his own psychoneural condition has offered an excessive inner resistance, and socially objectionable forms of conduct have thus continued, insufficiently transformed.

Adult delinquents, or criminals, commonly are but continuers of their youthful ways—ways now hardened into habit and extended by new knowledge and skill. To the contributing causes of youthful delinquency may then be added a few forces, such as contact in prison with experts in crime, and opportunities and incitements which come less readily to the young. And for adults, this should be added: that reclamation is never finished, is nearly always in need of restrengthening. Even when carried far in youth, it may still be too weak for what is needed later. A blow then to body or mind, the deteriorating effect of drugs, and more, a sudden opportunity to take unguarded wealth, may then contribute to crime in an adult of hitherto acceptable behavior. But with these, is the man's originally weak, or newly-weakened reclamation.

Violence and non-coöperation in factory, mine, and along the waterfront likewise have their peculiar character. Especially remarkable here, both the employer and the hired men are for the most part full members of the national community, in mind and externals; most of them are habitually non-violent and coöperative—as husband, neighbor, customer, voter, and any of a score of other regions of conduct. But in the one narrow zone of conduct—that between hirer and hired—in this narrow strip of economic relations, men may see red and be ready for self-willed compulsion.

And there are other peculiar contributing causes, including the employer's fear of loss, his desire for gain, his will to be free to "manage his own business," the employed man's desire for higher wages and shorter hours, for a "closed shop," for "recognition" of his union.

But these of themselves do not bring petty warfare; hardship far greater has elsewhere been borne without a blow. With us, where strikes and lockouts so often are next door to physical onslaught, the explanation must, I believe, include the fact that the psychic ties of community have been weakened specifically between these bodies of men. Each body thinks the best of itself, and the worst of its opponent; each believes that its opponent understands no language but force. In unnumbered ways a psychic gulf is made and widened, psychic bands are snapped, until disagreements otherwise amically manageable become seven times heated and explode.

Non-coöperation and violence between races within the nation are not to be fully explained apart from economic grounds of conflict. A distinguished economist, speaking in 1936 at London, held that the prejudice of Whites toward Japanese in California is due entirely to economics. The facts themselves, I am confident, make it clear that cultural and physical differences between race and race should be counted along with economic grounds.

But these forces would hardly lead to frequent violence were there not underlying them this important fact: that the communal feeling often is weak or lacking between White and Colored. This particular area has been insulated from the dynamic reclamational process. And in consequence, when purpose op-

[8] A judicious survey of current explanations of crime by youths and adults is in Nathaniel F. Cantor's *Crime and society; an introduction to criminology,* 1939, 12 ff.; and elsewhere.

poses purpose, the opposition here retains much of its natural explosive force.

Of *civil war*, there is cause upon cause. Factions of a nation disagree as to who should rule, as to the form of the nation's government, as to rights of some nationality or class, and so on into the distance. In our own case, there were cross purposes between North and South over slavery, its restriction, its extension, over a State's right to secede. These and other oppositions of aim, running into ten-thousand particulars, seem to many of us a full explanation of the War.

But more is needed. For serious cross purposes are part of the domestic life of every nation, and are not disruptive if there remains a strong sense of fellow-membership and common loyalty.

Now between North and South these uniting ties, never strong, had been seriously weakened; each side came to mistrust the plain honesty, the political integrity of the other, and felt alienated from the other; so that psychically they no longer were embraced by a common restraining fellowship. Inhibitions thus vanished, and oppositions of purpose were free to rise to such fever heat as is usual between savage tribes, or between nations wholly independent of one another.

International war, although considered elsewhere, should yet be borne in mind. As in each of the areas of violence already named, so here: each international contest has its special 'causes' —the economic, political or other objects which each desires and both cannot have; and the impulses, or 'drives' and more, to have these objects in spite of all.

Yet these of themselves do not suffice; for with grievous contrasts of possession and with drives abounding, men in great bodies are commonly found dealing with one another unviolently, coöperatively, *provided* there be between and over them the forces of a vital common community. The absence of this psychic factor must be counted an essential part of the explanation of the besetting violence between nations.

IV. The Bearing of the Present Explanation on Practice Generally

The account given, if correct, should be of practical effect. Inventive eyes will perhaps see it implying new devices for bringing the desired result and implying the rejection of some present practices that delay that result. But more confidently one may expect rather a change of accent—less emphasis on some procedures and more on others.

Particulars of the changed accent may be suggested.

1. There will be no less care than now for the 'problem' child who may seem a 'potential criminal.' But there will be far more care than now for *every* child, *every* youth, without exception.

For in plain fact, as seems clear, each of us begins as a problem child, potentially delinquent, be he boy or girl, normal or abnormal, of best or worst heredity—ready for violent self-will, unready for the steady and fruitful cooperation required for working membership in family, town, countryside, and nation. No child attains this by mere growth; every child, from his earliest years, must have constructive care.

2. When this is understood, we will hardly be satisfied with attempts to remove only what now are widely regarded as the causes of violence, among them being psycho-neural defect or disease, the sense of frustration, the broken home, dire poverty, the slum. The removal of these is to be desired on a hundred grounds. But even so great an accomplishment will not of itself solve the problem here in mind. The intolerable behavior of your healthy young

savage, whether of New York or New Guinea, is not the product of any one of these 'causes,' or all of these together; and after riddance of them all he still will need a positive process of reclamation that puts tolerable behavior in the place of intolerable. The most of what now are often called 'causes' are rather *obstacles* to this reclamation and must be removed. And after their removal, the dynamic process still is indispensable.

Nor is the problem solved merely by removing the hindrances to the satisfaction of desires—by giving the child what he wants, the employers or the employed what they want, the nation what it wants. The communal life always involves deep changes in the natural way of satisfying our wants, allowing us to satisfy them in some ways and not in others, to make our own satisfaction dovetail with those of others, to coöperate with our fellows in creating new wants, and in multiplying the ways of satisfying new and old. All this requires self-reconstruction, with help from others, and can be had by no mere appeasement either of individual, domestic group, or nation.

And seeing this, there will be fostered and reinvigorated all that now contributes to this human re-shaping—such as the finding of real homes for waifs and strays; regirding broken homes, creating new homes; supplementing the home life by the enjoyment and discipline of life in other suitable groups; the wisely guided work of juvenile courts; the work for mutual understanding across economic, racial, and international gulfs, and for whatever else will bridge the chasm. The genius available must be invited more and more to the many sides of this whole enterprise.

3. The dynamic process, while it will be directed against violence, will the more be directed constructively for certain great ends and for the means to reach them. And this will of course be by giving knowledge of these ends and means. But to support this knowledge, there must come marshalled psychic forces less honored in the academies—the forces of repugnance and affection, of purpose bent on upbuilding. Violence will be made known in its root, branch, and fruit; and, more, will be made generally hateful, feared as poisonous to what all of us must labor for in common. This concerted effort in its turn will become understood, will be valued, championed emotionally and in cool choice and act.

And even professors will come to feel it an idle doctrine that only knowledge can pass from one to another. For among American boys there is created a contempt for the 'sissie,' for the boy who would knock down a cripple, for the cheat in play; an admiration of the fast runner, for the boy of courage, the aviator; and a purpose is aroused in many to be such as these. Whenever a community sets its heart on objects that now are Germany's or Japan's, or on the very different objects that are prized in the United States, the community always finds a way to fix the affection of most of its oncoming members finally on such things. Virtue and vice, where there's a will, are thus generated. They are knowledge and yet far more than knowledge.

4. Each person will learn to include three great objects among those he respects.

a. The community as a living whole will be recognized and held in honor, both for the worth revealed in its past and present and also for what it can become if its members will. The community particularly here in mind is the nation, having ten thousand lesser communities within it. But, as every citizen should know, the nation never need be the permanent limit of the community's extension. For even as Massachusetts

and Virginia and eleven more independent bodies of men each overstepped the bound of its colonial community, so can it be with the nation itself; it can, as England and Scotland did, enter into a still larger community of nations until all peoples are embraced in it.

The respect due the community will steer a course so charted as to keep the rock of wild nationalism with its wrecks of nations—Germany, Hungary, and many more—well to starboard; and off to port, a rock of under-cherished national life—a rock on which France recently, and in 1861 our own country, nearly foundered. Healthy honoring there must be, and healthy dissatisfaction. The esteem must be warm, watchful, unfanatical; the criticism, the opposition, must be a loyal opposition.

There will also be conveyed in the dynamic process many a particular of the thought and conduct that befits members of so august a life in common. And there will be formulated principles upholding these particulars, to make it both clear and impressive that the respect is sentiment and emotion and more—is a profound intelligent purpose strong to rein-in headlong action, and, no less, to be whip and spur and guide.

b. In the community the member will accord recognition and respect to his fellows as individuals. This and the honoring of the community as a living whole—to maintain both of these at once is no easy psychic matter; for each of the two directions of high regard easily distracts attention and affection from the other. In Japan, for example, a respect for all individual Japanese is unhealthily overshadowed by reverence for Great Japan, *Dai Nippon,* and its Emperor; even assassination is without dishonor, if done from devotion to the State. In the United States, in contrast (of this, more will be said later), individualism threatens the honor due the nation-community. The Scandinavian peoples, although not they alone, seem commonly to maintain the required upright posture of mind. The worth of the national community is borne in thought and will, as is also the worth of one's fellows—men, women and children; all, with care for their welfare, for justice to them.

c. Each member must respect himself—it seems hardly worth the saying. For has not nature itself munificently endowed most of us, each to hug to his bosom until death his own ego? And yet this very fact offers to the dynamic process a nut to crack hard as hickory. This love must be tempered. In contrast, our native readiness to become mindful of the community as a whole and of its members severally is given us by nature as by a niggard; and this love's ashen embers must be fanned to flame.

But the social task is not aimed to quench self-love utterly, even though the self-will bound with it is the root of violence. Rather, the dynamic process comes to no large success until the youth, the man, has been brought to accept as a part of his self-regard that he be civil and no rowdy.

And self-love will be respected by granting a place to solitary thought and appreciation and work, leaving us somewhere between Thoreau who ceased to exist when in society, and the character in Henry James's story who went out of existence whenever he was alone. Psychic recovery of the self by 'time out' from social connections—of radio, telephone, movie, newspaper, and all the rest—may some day seem suited, not to hopeless introversion, but to the good fight.

On the other side there will be correctives of egotism, in the amenities between men in their mutual courtesies; and, deeper, in their morals, which remind us to curb our self-importance and to notice the worth in others.

Intolerance, also, there will be of the hoary untruth that self-interest is all we have and are, either by nature or by training; that the appeal to anything else is flute-toned ineptitude. In fact, every community worth its salt rests in large part on its members' rock-solid loyalty which makes them fight—as today our own men do in every quarter of the world—less to save their own skin than for the great company in which each is enveloped and enlarged.

Enlightened self-interest alone has never yet given birth to such devotion; and only dreamers will expect to win men from their jungle ways merely by enlightening their self-love by so-called 'moral' movies of gangsterdom, for example, which teach, it is held, that violence 'doesn't pay,' that in the end the criminal is always caught and punished. But quite apart from the fact that, with us, many a criminal is *not* caught and even if caught has an excellent chance of escaping punishment, such a teaching wins few or none to take a hearty part in the nation's full life, in peace as well as in war.

The appeal to something beyond self-interest can have its place even in politics. William Kent of California, running for Congress, would in some stronghold of high tariff—of sheep men, let us say—tell them to their face that the proposed tariff on wool did indeed put money in their pockets, but at the expense of every man, woman, and child in the nation, an injustice which, deep in them, they could not support. They respected him for this and gave him their votes.

5. The channels through which the energies of reclamation flow will be guarded against clogging or pollution—such channels as the family, school, and worship; the newspaper, movie, and radio—by every device of educating men of every age and kind.

Of these, the psychically sound family stands first. And we shall gird ourselves for its honor and power, against whatever cheapens it or saps its strength. One can hardly say that in recent years our chief producers of entertainment and those who support their work—of the stage, novel, and screen—have felt their full public responsibility in this, when the violations of the plain domestic loyalties are made laughable, and to trample on them appears the sign of rich vitality. In the end social experience will scarcely favor this onslaught on the most effective of reclamation institutions, coupled as it is with revolt against moral and other schooling of natural impulse.

Nor will social experience probably come fully to favor the free play of such forces as give economic production and sale a place above reclamation by encouraging men, women, and youths to give their powers chiefly to commerce, production, and its services, disproportioned to our full physical and social need, and often at serious cost. The community will come to distrust this trend, to distrust also the excess of commercialized entertainment and the excess of commercialized transportation by which human relations are distracted beyond necessity, particularly in childhood and youth when reclamation should be at its peak and the members of the family should not be as atoms of gas. No community, it is true, will coerce the major part of its membership in such matters. But it cannot with untroubled mind see impaired the principal means to its own well-being.

So much for the needed action in every nation-community, since men everywhere have a like nature to be reclaimed and like powers with which to reclaim it. And yet each people also is unique, and its practice must be fitted to its special needs. And so it may be well, in closing, to turn to the situation in our own country.

V. OF VIOLENCE IN THE UNITED STATES PARTICULARLY

In what follows, there is of course no intention to portray the nation's mind. In our strength and manhood we have corporately achieved great and humane things, and have power and purpose for achieving things greater still. With all this never to be forgotten, some obstructions to this high public purpose may be observed with no other thought than to clear them away and give freer course to our people's creative will.

And so at once to our lawless use of force—between employers and employed, between our Whites and our men of the Colored races, between our States in a bitter Civil War, by our youthful delinquents who give the nation deep concern, and by our adult criminals who commit not only minor crimes but offenses of such gravity as homicide. We should seek out the special forces that with us impede reclamation and the special efforts called for to allow this process a freer course.

The chief factor in causing all this in our country is not—so the evidence seems to show—the frontier, the frontiersman's way of life, so often offered in explanation. For in many a country the frontier and lawless violence have not, as with us, gone hand in hand—in Canada or Australia, in New Zealand or South Africa. Conquering the wilderness does not inevitably make civilized men recklessly ready to take the lives of individuals of their own name and culture.

The energetic factors in our own case seem to be many, intermingled. It may be well at first to name them as though each had a separate existence. Later we may have reason to believe them, most if not all, to be as branches of one tree, and their bitter fruit to be due, I believe, not to an intrinsic evil in any of these factors by itself, but only to the simple fact that it is permitted to act in excess, uncountered by what should act with it, tempering it.

The first of these forces would seem to be *an uncorrected love of liberty*—life-giving, life-guiding as is this national love of ours, especially to be treasured and guarded when humanity is suffering as never before from tyrants.

One often hears of the positive, the constructive things that are meant by liberty. But, for too many of us, our nation's watchword is but an urging to brush all social restrictions aside with "Hands off! I know and go my own way."

Our watchword, Liberty, standing alone as it does, says nothing of what must be done by free men, sets forth none of the purposes befitting men who, while free, yet would live together and maintain a national community. The French, by the time they chose their three-fold watchword, had perhaps become less romantic, less beset than we were with Rousseau's wayward psychology. They determined to remind themselves hourly that they must not only be free but also be bound—bound to respect others of their nation as their equals, bound indeed to feel and act toward them as kinsmen.[4]

Americans may well have this full corrective tincture in their veins. The love of liberty will still remain with all its

[4] Under Napoleon, the triple motto of the Republic, quite logically it would appear, suffered some eclipse. In a collection of autograph letters of Napoleon and his Marshals, shown me by my friend, Mrs. Frank Sheldon, and now a gift from her to the University of California, all the printed heads of the Marshals' letters, of dates from the sixth to the eleventh year of the Republic, bear, of the three words, only the two: *Liberté, egalité*. Of Napoleon's own letter, in the twelfth year, the engraved heading of the seated figure with sword and cock-crested helmet, refers explicitly to the French People and to Bonaparte, First Consul of the Republic, but with not one of the three words of the republican motto.

self-reliance, its hate of tyrants, but with these now given the counterweight of a conscious and treasured partaking in an enterprise that brings into action all one's powers, sharpens them, and gives them great things to do.

A second force is our *uncompensated insistence on rights*. The Federal Constitution includes an early series of amendments known as the Bill of Rights. And whenever the purpose of some person or group frustrates the purpose of another, is it not a trait of ours to cry out anxiously first of all, "Am I, is my group, not being deprived of its rights?"

The corrective here is not that we become careless of what is owed us by others, but that we give no whit less care to what is due from us to them, and no less insistent on search and research to acquire by ingenuity and dogged will, what we can of this compensating solicitude. Schoolmen and those in a score of other occupations will have to study, experiment, and try, this way and that, toward an equal pertinacity to receive and to give what is the very right of each. This limitless enterprise will enlist all the services of religion, of patriotism, of art, of science. We may not care to have the Constitution contain a Bill of the Obligations of each citizen to each and to his nation, but we must be deeply discontented that these obligations are not set down in the constitution of the American mind. Obligations, like rights, must have their hold on our emotions, our affections, our purposes. No less than this will be the task of the dynamic process suited to our nation.

Next of the forces for self-will and violence, strangely, is *our splendid concern for the individual*, but unbalanced often, having become an 'ism.'

Now individuals cannot be overvalued, cannot with impunity be valued mistakenly. And individualism runs often, not to prizing each man and all men together, by each and all, but to an esteem by each for himself nearly alone. Each moves toward leaving others out, toward leaving out the community of himself and these, save when they can serve him. Egoism or egotism would be a less flattering but more precise name for this. The nearly exclusive prizing of oneself is close to the insistence on rights, meaning often the insistence only on *one's own* rights, is close also to the love of liberty, often a love of one's own liberty alone.

Consequently whatever corrects these other two will aid against this third. But in addition, the need in the 'ism' regarding the individual should be fully recognized and its bubble-pride pricked. For science is against it and the art of life. The community will be valued for itself, even as individual members will be valued each for himself. They need to be valued by the community; and they need to value the community, because of the dynamic process that reclaims them and sustains the common life. This reclamation, to whatever degree it is accomplished, makes each of its members more than an egoist, more than a champion of his rights only, more than a lover of liberty free of bonds. Instruction and all else will be restless and inventive to accomplish this correction.

Among the obstacles to such an attainment is the form of psychology which holds human beings to be mere machines, run by impact of the outer world. Attractive to many in our country, this unproved assumption chills confidence in the creative power and the worth of the three great objects whose valuing is central in the cure of violence and in well-aimed coöperation. The net weight of scientific evidence is, I believe, against the mechanists' theory of human action.

Another obstacle is a current doctrine

accepted as though it bore the seal of scientific proof. Children, it is asserted, must be freed of inhibitions within or without, should each express his natural promptings, and thus achieve a personality all his own. It is a half-truth inflated. It disregards the individual's need of coöperating with others from the beginning, for his own reclamation from crass impulses toward violence and non-coöperation. By the half-truth, individualism takes possession of the very babe and does its best to keep him wild.

For in fuller truth, individuality, originality, personality worth the having, comes from no such source. In our own country, Washington, Jefferson, Franklin, Emerson, Lincoln, William James, Edison, Wilson, arose by no insulation from the psychic currents of their time and nation, but by baring their minds, selectively, to these currents. Even Thoreau, Whitman, and Gibbs, trebly insulated it might seem, were actually permeated by certain of these currents, were inwardly transformed and invigorated by them. There is no evidence that apart from these currents their genius could have come to great results.

Those who would prepare themselves or others for creative individuality must know and accept these plain facts. An early training to disregard them, to feel no responsibility for a wise choosing and using of the psychic resources ready to make fruitful his own inner powers—all such guidance by self-deluded or misguided elders is probably as sure a way as has yet been found to frustration, misshapen personality, unfitness to cooperate, and readiness for egregious self-will.

Further, is there not in our people *a certain tolerant eye—indeed often a favoring eye*—on *violence itself?* That we are so, seems clear. A patient reliance on persuasion to right some wrong to one's self, one's group; a confidence that the community as a body will in time redress the injustice—this is not our eminent national trait. It was not characteristic of the colonies in 1776 nor of the States of the Union in 1861. Jefferson himself regarded an occasional rebellion as necessary to the public health.[5] A lone highwayman, "Black Bart," has a proud tablet in his honor on the wall of a town of California. An efficient gangster, with us, is no object of universal detestation and horror. On the whole, we approve rather than condemn one who takes 'the unwritten law' into his own hands. The nation's very Constitution guarantees against infringement the right of the people to keep and bear arms—that is to say, to possess the means of violent self-assertion against a fellow citizen, even against the government itself. This public attitude, so variously and seriously expressed, is the very climate for our abundant delinquency and crime, for ruthless economic conflict, for riotous injury of race by race, even for civil war.

Ways there are to change this climate of ours. As a people we can educate ourselves toward zeal for justice—prompt, sure, by the lawful means of justice. With this in mind, the laws, the courts' procedure, the quality of our judges and of the laws' enforcement can be scrutinized and held to the highest standards.

This zeal, created by instilling knowledge and more, will include a stout public prejudice against righting wrongs by private compulsion, especially by violent compulsion, against extorting even our clear due from others by private force. The individual, the group, the class, the race, that resorts to such force, must be branded as an enemy of the governed community, as a traitor. Such a prejudice will not be frowned upon merely because once in three centuries

[5] *Letters and Addresses of Thomas Jefferson,* ed. Parker and Viles. 1905, pp. 54 and 65—to Madison, and to Colonel Smith.

perhaps a democracy may be justified in rebelling against its government.

But the zeal, the prejudice, will hardly win through until there is some deeper healing of the mind, a lessened alienation, a greater respect between the violent man and his opponent. Only when the common bond between them outmeasures their common repulsion will the natural impulse be withheld from downing by force any opposition to one's will.

Finally, *in many of us there is a distaste of being governed,* a distaste that gives aid and comfort to violators of law. This feeling is of no recent day. In the States when the Union was not yet formed, it was more than distaste, it was an open forceful opposition, to courts of law, to all manner of political rule.[6] In North Carolina, many were persuaded that the proposed "Federal City," now the District of Columbia, would be a fortress of despotism, from which would issue an immense army to disarm and enslave the people. In New England, thousands arose in arms against taxes, courts, and government itself. A different spirit prevailed, but the early distrust continued and was written into the nation's basic law, with its checks and balances to prevent the abuse of power. Government still seems to many a necessary evil. For even to this day there is a grumbling acceptance of it; and in many there is enough of feeling and impulse behind the grumbling to make it easy, when private interests are opposed, to flout the law if we can. Thus under our very feet are seed and soil of violence.

Counterweights to this distrust are to be had, but only through wide instruction by numberless means.

[6] The reader who has not already done so should read Popular Antagonism to Government, Chap. 8, pp. 288–318, Vol. I, of Albert J. Beveridge's *Life of John Marshall,* New York: Houghton, Mifflin, 1916, 4 vols.

There can be created, in young and old, an even deeper distrust of *not* being governed. For instead of government being intrinsically an evil, it is an indispensable good, indispensable for what is most prized by our people—liberty—defense against the powerful and violent, an assured enjoyment of one's rights, a large education, an opportunity for a wide choice of rewarded work, for discovering and developing one's latent powers. A people ill-governed loses some of these; a people ungoverned, in anarchy, loses them all.

But our new preparation for citizenship will not be satisfied with recognizing this value in government. Our citizens will have a constructive discontent until they have a certain quality of government, a government that gives the least possible excuse for contempt and suspicion, so excellent will be its work throughout. The effective purpose will be for the right means as well as the right results, careful that its servants are men trained and, above all, men of character; as intolerant of quack officials as of quack doctors. If, generation on generation, we study to have it so, we can have as our governors the best in the land.

A way thus seems open to a better understanding of our destructive clash of purposes, as well as to a union of purpose with purpose in constructive work. And out of this, it would seem, can come a surer practice, with larger success in reclaiming men from their raw readiness for self-assertion, and their raw unreadiness for fellow-labor.

"But," the reader may have thought all along, "the taming that wins men from physical onslaught only, important as this is when the world is losing its youth by millions and has lost all normal living because of physical onslaught,—such crude taming will still leave men of self-will ready to injure their fellows in a hundred ways of disregard or ma-

levolence, without bodily assault upon them. And even coöperation may have but a fair surface, beneath which may be an advantage of a few at a cost to all the rest. Self-will, self-seeking, by this non-violent route may be more sinister than the open use of force."

This is true: the purpose to attain one's own ends, regardless of the purpose of others, may thus move underground. And yet the psychic energies of reclamation do in fact oppose not only open physical outrage, but do also ferret out the concealed abuse of power, including the almost limitless power generated by coöperation. The dynamic process of reclamation strikes at self-will itself, individual or collective, at self-will that forgets or intentionally tramples down the interest of others. As we have seen, the process has a large measure of success between citizens, although as yet it succeeds ill with some. Even of the reclaimed, the most of us are imperfectly reclaimed. But in whatever degree it succeeds—a degree capable of indefinite heightening—, the community does to that extent create an inner respect for one another and for the community itself. And in so doing, an axe is struck at the root of both the seen and the unseen intentional outrage.

Our study, it would appear, thus gives promise for understanding and for practice; both for reducing violence particularly in our own country, and for replacing it by constructive work. And although in the present paper the nation's domestic life has almost alone been in mind, yet as an earlier paper has suggested, the full inquiry bears no less directly on the present and recurring tragic turbulence of international life.

ARE PSYCHOLOGICAL DATA AND METHODS SUBJECTIVE?

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I. Introduction

The frequency with which the terms 'objective' and 'subjective' appear in recent psychological literature would seem to be symptomatic of solicitude for the status of psychology as natural science. The *enfant terrible* of psychologists, the charge of subjectivism, has stung certain of them to demand objectivity for their special subject-matter and concepts. Witness, *e.g.*, Professor Tolman, who insists that psychology seeks "the objectively stateable laws and processes governing behavior. . . . The laws and processes determining this their behavior are stateable in objective terms. Even in the cases where the organism is oneself, these determining factors can and must . . . be stated objectively." ". . . immediate experience, just as it appears, contains quite as much objectivity as it does subjectivity. Immediate experience, as initially given, [is the] common matrix out of which both physics and psychology are evolved." [1]

This plea for objectivity, we believe, is essentially emotive and honorific in character. What, *e.g.*, is meant by 'objectively stateable laws'? In truth, psychological laws *per se* are neither more nor less subjective than are physical laws. All empirical laws, both psychological and otherwise, are but propositions which affirm some 'invariant relation' or 'constant conjunction of characters' between or among some class of things and events. Hence the significant questions we can ask of propositions are whether or no they are communicable, and whether or no they are capable of empirical verification, or, in operational terms, whether or no a plurality of investigators, employing the same observational or experimental operations, succeed in instituting the same consequences. Moreover, what is meant by saying that "immediate experience contains quite as much objectivity as it does subjectivity"? Indeed, as we shall see later, the distinction between objective and subjective is never a deliverance of experience *qua* immediate; it is the outcome of reflective operations. As immediate, experience is irrational or uncognized; it is only in virtue of reflective inquiry that significant orders and relations are discriminated within it.

Consider also the claim that "Immediate experience, as initially given, . . . [is] an initial, common matrix out of which both physics and psychology are evolved." In the sense that empirical science seeks invariant relations within some domain of things and events, then, truistically, each empirical science is on all fours with every other. For every science, psychology included, concerns itself with some domain of perceptual data. If the data and methods of psychology are subjective, then, in varying degree, so also are those of the other empirical sciences and for the same reason.[2] The case is much the same if we turn to scientific concepts and laws. If by 'subjective' it be meant

[1] E. C. Tolman, Psychology versus immediate experience. *Philosophy of Science*, 1935, 2, pp. 356, 359.

[2] For elaboration and proof of this contention, see Part IV below.

that these depend for their existence upon the person having them, then, as Pratt points out, "all science is subjective. Objective knowledge . . . can mean nothing more than the cancellation of idiosyncracies by the process of pooling, sifting, and weighing all the bits of individual subjectivities. The result is still subjective, for there is none other available. . . ." [3] Yet this is but to say that scientific methods and laws are formulated by human inquirers and possess neither meaning nor existence apart from operations instituted by some investigator. This is as true of physics as it is of psychology.

There is, accordingly, a sense in which concepts and hypotheses may be described as subjective whereas their empirical referents are not. The ultimate referents of all empirical knowledge, both psychological and otherwise, consist of things and events perceivable in space and time, whereas concepts, methods and laws are not thus perceivable. Yet, there exists no metaphysical or epistemological gulf between concepts and laws on the one hand, and perceptual facts on the other. For concepts without percepts are devoid of empirical meaning; conversely, percepts without concepts (meanings) are blind and uncognized. Indeed, concepts are but percepts that have assumed a logical or cognitive, *i.e.*, a generalized, function for thought. In operational terms, a concept or meaning is an operation that functions as a response to a plurality of sensory stimuli or of other concepts. Since the relation between concepts and percepts is functional and reciprocal, concepts (meanings embodied in the form of propositions) are objective only in the sense of verifiable, subjective in the sense of unverifiable. Indeed, within the domain of the verifiable, some concepts may be distinguished as more objective than others.[4] This functional reciprocalness between concept and percept will become clearer if we distinguish the various meanings of the term 'fact.'

The term 'fact' embraces a number of meanings which for present purposes may be reduced to three. (1) 'Fact' sometimes denotes objects and events discriminable in sense perception, together with certain relations perceived between them. "The end of this pointer coincides with that mark on the scale," "This band of color lies between those two bands," are facts in this sense. Facts in this sense are distinct from the hypothesis we make about them; indeed, such facts are instituted or sought out by us in order to test the hypotheses we make. (2) 'Fact' sometimes denotes propositions which interpret the data discriminated in sense perception. "This object is ferrous," "That object is a protozoan," are facts in this sense. All inquiry must take for granted a host of facts of this kind, although we may later reject some of them as false. (3) 'Fact' also denotes propositions which truly assert invariant relations to hold between or among a plurality of perceptual objects and events. "All planets revolve about the sun at velocities such that their radii describe equal areas in equal times," "Any nerve fiber must either respond with its whole capacity for response or none at all," are facts in this sense. A hypothesis is made true, is verified, and thereby in turn itself becomes a fact, when, as an experimental operation, it leads to the discovery or institution of facts in the first two senses. For purposes of science, all facts may be described as 'constructs'; they are not brute 'givens' parading before awareness for anyone to read who runs.

[3] C. C. Pratt, *The logic of modern psychology*. New York: Macmillan, 1939, p. 54.

[4] In the sense of differences in range of denotative reference possessed by them. This point we develop further in Part III of this paper.

II. SUBJECTIVE VERSUS OBJECTIVE: CONVENTIONAL CRITERIA

Unhappily, when the attribution of objectivity to psychological subject-matter and methods reduces to wishful thinking or dogmatic affirmation, such apologetics succeed only in casting suspicion upon psychology as natural science. If, however, we turn to those writers who specify some criterion whereby the distinction between objective and subjective may be drawn, *at least four such criteria come to light.* These are (1) the degree to which 'personal' factors such as emotion and desire distort perception and judgment; (2) the degree to which the contents of perception are dependent upon, or are independent of, the act of perceiving them; (3) the degree to which an object or event perceived in psychological space is identical to, or distinct from, the 'true' or 'real' object or event as determined by further tests; and (4) the degree to which perceived objects and events [5] are open to 'public' observation and verification. We present an analysis and appraisal of each of these criteria in the order mentioned.

(1) That emotion, desire and other 'personal' factors distort perception and judgment is a commonplace. The distortions occur, however, not because these factors are integral to the person who perceives or infers, but because they vary widely in character and degree of influence from person to person. To the degree in which the factors that determine the specific content of a percept or judgment vary, the actual content perceived, or the actual inference arrived at, will likewise vary. If, on the other hand, a given emotion 'x' were always present in the same way and operative with the same force in every percept or judgment, then, other things being equal, the belief that emotions distort perception and judgment would in all likelihood never arise. Suppose, by analogy, all things in the universe, including our sense organs and measuring rods, were suddenly to double in size. Even so, we would never detect the change; all things would continue to be perceived as of the same size, and all measurements would continue to yield the same values, as before. If, accordingly, the same emotional disturbance were always present in the same way and operative with the same force in every perception and judgment, we might indeed possess added grounds for affirming a universal relativism in all perception and knowledge, but nothing more. Unless we identify subjectivism with relativism, subjectivism would never be identified with illusory perceptions and false judgments traceable to emotions and other personal factors.

The real difficulty confronting the psychologist lies in another dimension; it consists in the complexity of his subject-matter and the great variety of methods necessary to its understanding and control. Put otherwise, the behavior of men and animals involves a far greater number of causal variables than do the phenomena investigated by physical science. Suppose two subjects are assigned the task of memorizing a poem. It cannot even be said that we know all the factors that at a given time condition the methods and rates of learning of each subject, much less the relative influence of each factor at a given time. Indeed, both the factors themselves and the degree of influence of each will vary from individual to individual and from time to time in the same individual. Hence it cannot be expected that psychological investigation will in general yield the same unanimity of results and the same degree of predictibility of future behavior as will investigation of the much simpler subject-

[5] By 'event' we include the qualitative characters of experience.

matter of the physical sciences. If this be what is meant by subjectivism, then those who deprecate psychological methods and subject-matter as hopelessly subjective display not wisdom but merely their own naiveness.

(2) Are some objects and events objective in the sense that they exist apart from our perception of them, in contrast with which others are subjective because they possess no such independent existence? Are some concepts real or objective because they possess a determinate character and validity independent of our thought about them, and others subjective or unreal in that they do neither of these?

Now if by 'objective' it be meant that any given content of experience is distinguishable from the act of awareness of it, then anything discriminated in experience is objective. But if by 'objective' it be meant that objects exist and events occur apart from our perception of them, then *some* of the contents of perception would seem to be objective and *some* subjective. The distraught devotee of spiritualism may 'see' a deceased husband 'materialize' in perceptual space, while less distraught and less suggestible observers see no such thing. On the other hand, all readers of these pages believe them to exist and to be in this sense objective because they are reported perceived by all normal observers who place themselves in certain objective relations to them.

As regards concepts, some may be designated as objective and some subjective. The concept 'fear' is objective in that it denotes a class of actual behaviors; the concept 'substantive mind' is subjective because it designates no observable referents. Propositions, too, may be distinguished as objective and subjective. Propositions are of two kinds, formal and empirical. Formal propositions are those that make no necessary reference to perceptual facts; empirical propositions are those that possess neither meaning nor truth value apart from reference to perceptual facts. Thus the proposition, "The angles of a plane triangle are equal to two right angles," possesses definite meaning and voices a truth independent of any reference to perceptual facts and in this sense may be classed as objective; the proposition, "Two equal quantities are always unequal," is subjective because self-contradictory and false. Empirical propositions, likewise, may be objective or subjective. The law of gravitation is objective because empirically verifiable; the proposition, "Certain character traits are causally related to specific cranial measurements," is subjective because unverifiable.

Now all empirical science, psychology included, is concerned both with concepts, theories and laws on the one hand, and with percepts or existential data on the other. Since all empirical statements, both psychological and otherwise, initially arise from, and are ultimately verified by reference to, perceptual facts or data, we find no rational ground for restricting objectivity to the subject-matter and concepts of the physical sciences. For *all* empirical statements initially arise from, and in turn refer back to, the 'common matrix' of things and events disclosed to sense perception (facts in the first two senses above). If the existential data of physical science are objective, then so also are those of psychology and for the same reason. The color of a strand of yarn and the behavior of a child learning to walk are quite as objective as the motions of a star or the pointer reading on a scale. In terms of verifiability, the laws of learning are quite as objective as the law of gravitation, for both are verifiable in terms of perceptual facts.

(3) We turn to the distinction between objective and subjective that is made to rest upon spatial criteria. It

will be instructive if, first of all, we cast a glance at the manner in which spatial criteria came to be definitive of this distinction.

The dualism between 'thought' and 'thing,' 'idea' and 'object,' the 'inner' and the 'outer,' the 'subjective' and the 'objective,' formulated and developed during the early modern period, was, prior to Kant, generally conceived in spatial terms. Two factors, one mystical, the other scientific, gave credence to this dualism. The first was the assumption that 'mind' and 'nature,' 'soul' and 'body,' are both substantial existents spatially disparate from one another, in consequence of which psychological events were construed as inner and mental and physical events as external and material. The second was the growing tendency of the new physical science to abandon psychological data and concepts as descriptive or explanatory of physical nature. Needless to add, this substantive mind remained conveniently at hand as a dumping ground into which these troublesome surds might readily be disposed. Later, at the hands of Hume and Kant, there was finally achieved the complete 'subjectification' of the entire content of both perception and knowledge. Indeed the highly epistemological character of modern thought stems largely from this assumption. In specific, this dualism was responsible for that bewildering array of theories as respects the relation between the content of perception and knowledge on the one hand, and their alleged external referents on the other, designated by the terms 'realism' (whether monistic or dualistic), 'subjectivism,' 'solipcism,' 'objectivism,' 'radical objectivism,' 'interactionism,' 'parallelism' and 'double-aspect theory.'

Moreover, within this conceptual framework, certain traditional theories, as, *e.g.*, that of Descartes, postulate the primacy of the subjective, whence it was assumed that, given the existence of the 'self' or 'mind' as self-evident and self-enclosed, we could then logically deduce the existence of an objective world spatially distinct from the perceiving and knowing mind. Unhappily, all historic attempts to bridge this gap have failed, for, once we enclose all things and events within the orbit of a 'mind' construed as spatially disparate from the objects and events it perceives or knows, no labor on the part of thought, which was itself assumed to reside wholly within this circle, can lead us out again. The error consists in taking as simple, constitutive and spatially disparate existents that are in truth complex and dependent, relative and functional, in character.

Per contra, there remain many writers, especially among American New Realists, who affirm the spatially objective to be fundamental and determinative. Man, it is now argued, is an instinctive[6] objectivist; he first becomes aware of things and events external to himself, and only later of his own 'inner' world of conscious content. An infant reaches for the moon or for a toy; do not these acts, our Realists contend, *imply* that the objects reached for are 'there' external to him? Not at all. For an act of reaching implies nothing; implication is solely a relation between propositions; one object or event never implies another object or event. Moreover, we believe that the distinction between the 'self' and its content on the one hand, and an external world of objects and events on the other, is wholly relative and reciprocal. In any case, the moment we discard all metaphysical Idols of the Theatre, we discover that the genuine problem is neither how we

[6] By 'instinctive' our Realists mean that man's earliest and most universal form of behavior consists of motor responses directed to or toward objects and events in extra-cutaneous space.

derive the objective from the subjective nor the subjective from the objective, but, rather, how each comes to be distinguished *pari passu* from the other within that domain of objects, events and relations that we call experience.

There is, however, a logical ground for the rejection of spatial criteria as *ultimately* definitive of the distinction between objective and subjective. For the moment we assume spatial relations as ultimate and constitutive, there is at once generated a maze of pseudo-problems as respects the actual locus of the contents of sense perception.[7] Take, *e.g.*, the perception of the color of this paper. You are all familiar with the contemporary psychological account of the causal factors involved in the process. But *where*, in terms of this account, is the color located? If the color as actually perceived is not a property of the paper independent of the perception of it, if, *i.e.*, the color as perceived is not the actual stimulus which evokes the perception of itself, where is it? Must it be given residence in a 'mind,' or, if not there, in the brain or other portion of the perceiving organism? Or, if in none of these, is the color somewhere between the mind or organism on the one hand, and the objective stimulus on the other? Or is the color 'ejected' by the mind or organism? In view of the present widespread suspicion that this problem is insoluble when posed in such terms, it would seem not unreasonable to conclude that spatial criteria fail to provide the basis we seek in order adequately to distinguish the objective from the subjective.

Nor is the case otherwise if we attempt to localize events in intra- or extra-cutaneous space. Are psychological events *within* the organism, physical things and events *outside* it? Or, may we locate some psychological events, as, *e.g.*, a feeling of pain, *within* the body, and others, as, *e.g.*, a color quality, *outside* it? Despite the usefulness of spatial distinctions for practical purposes, analysis will show, we believe, that the question whether or no the color I see is numerically and qualitatively one with the color you see is no different from the question as to whether or no the pain I feel is numerically or qualitatively one with the pain you report you feel.[8] In both cases, sensory cues, as they appear in psychological space, merely define the locus and direction of our responses; they do not, in any literal sense, constitute that in terms of which distinctions significant for purposes of systematic science may be found. Indeed, from all that analysis and experiment can show, the *esse* of both the color and the pain may consist solely in their *percipi*.

It must be admitted that without some change induced within the organism there is neither awareness nor response of any kind. Yet the awareness or response is in no useful scientific sense describable as *in* the organism; in truth, it is more accurately descriptive to say that both internal and external forces are causally implicated in every state or act. Consider, *e.g.*, a feeling or emotion. Whether as conscious state or quality, or as physiological, neurological, bio-chemical or other process, the state or act is the result of interactions between dynamic forces within or integral to the organism and some situation affecting it. True, many states and acts may be describe as within, of, or by an organism, yet, in any existential

[7] We may, of course, take a naively realistic view of the contents of sense perception and affirm the color to be precisely where it is perceived to be irrespective of whether or no we perceive it. Although we cannot here belabor the point, we believe that this position is, at least for purposes of systematic science, indefensible.

[8] This point will receive more extended analysis and justification in the next section.

and causal sense, they are no more dependent upon the one than upon the other. To ascribe a property, state or act to a thing in isolation is mystical, not empirical. Moreover, this is as true of 'physical' as of 'psychological' events. Suppose, *e.g.*, we say that coal is combustible. While for linguistic purposes this is convenient and for practical purposes useful, in any literal sense the statement is false. For combustibility is but a name descriptive of certain observable consequences that result only from interaction between the coal and something, usually oxygen, external to it.

It may be granted that for many purposes differences discriminated in psychological space are of extreme importance. In order to seat myself on my office chair, I must conform my movements to certain visual cues in psychological space; in order to treat a disease, a physician must prescribe some treatment or surgery for some specific part of the diseased organism. Indeed, all concrete things and events are in principle, if not always in fact, both spatially and temporally discriminable from one another. Yet the spatial properties and relations discriminated in psychological space are always specific and unique; they are psychological, not logical. What we seek is a criterion for distinguishing between the objective and the subjective that is logical and conceptual, not psychological and perceptual. This we set forth in Part III of this paper.

(4) Finally, we turn to consider the distinction between objective and subjective that would identify the former with those data that are open to 'public' observations and report and restrict the latter to what is in fact or 'in principle' reported as perceived by but a single observer. It is deemed a truism that my toothache is unobservable by another person in the same manner in which a color is observable by him. Yet precisely how do we know that two persons perceive the *same* color, whereas each perceives but *his own* and *private* pain?

That two reporters perceive the *same* color, whereas each perceives but his own and a *different* pain, cannot, we believe, be shown. Since each observer must report, we have no indication of what each perceives save as evidenced by their several reports. How, then, do we know that each succeeds in seeing the same color though not the pain felt by the other? Surely not in terms of any orthodox theory of perception now in vogue. For, according to accepted theory, the color *I* see is the result of stimulation of *my* retina, the color *you* see is the result of the stimulation of *your* retina. The stimuli that activate my sense organs are numerically different from those that activate your sense organs; that is as true in the perception of the colors as in that of the pains. It may, of course, be argued that in the one case the stimuli have a common source whereas in the other they do not. Yet if this be the case, the numerical identity or diversity of the actual stimuli are not themselves data of perception; they are 'physical constructs,' the results of inferences made from data present in nature or instituted by experimental operations. Even in the case of similarity of verbal reports, the evidence in support of the belief that the two observers perceive the same identical color rests upon an inference from analogy. Assume the two sets of stimuli to be similar, assume a like similarity in the retinal and other physiological structures of the two perceivers, assume similarity in conditions of the environment, assume causal determinism to be descriptive of all natural events, then we infer that the colors seen by the two observers are qualitatively if not indeed numerically the same. The situation is precisely the same as regards the pains felt.

The case is not otherwise if we take an operational view of the alleged verification of the identity of the colors seen as contrasted with the duality of the pains felt. The one may point to a tooth in his head and say, "The pain is *here*"; the other may point to a tooth in his head and say, "The pain is *there*." That each feels a pain numerically different from that felt by the other we believe to be a fact. Each observes and reports only his own pain. The case is precisely the same as regards the colors perceived. Suppose that, to the request to select the white from a number of variously colored yarns, each of two subjects picks out the same strand. Yet how do we know that each sees either numerically or qualitatively the same color? We can only infer that they do by convergence of their several responses upon the same object. But do the two responses actually converge upon the *same* object? As regards the object responded to, two meanings of sameness may be distinguished: (*a*) failure on the part of either or of others to perceive a difference, numerical or otherwise, in the objects grasped by the several responders; and (*b*) some identical object, not *perceived*, but *inferred* on the ground of causal necessity, to be the identical and original source of the several stimuli that give rise to the several perceptions and responses. In the first case, however, and the one alone with which we are for the moment concerned, the specific locus and direction of the several reachings and graspings, as well as the convergence of them upon the 'same' object, are functions of numerically different stimuli on the part of the several responders.

Suppose, now, a third person reports that he perceives both to grasp the same strand of yarn. Does not this verify the claim that a single, public object is grasped by both? Yet this third can report only that *he* perceives, the reported content of which remains the report of a single observer and, hence, is not as yet public. Suppose the reports of a number of additionai observers agree with that of the third. While each reports the content of his own perception, their reports agree, however, *in what they perceive*. This agreement of reports as to what is privately perceived, we believe, constitutes the element of lasting value in the distinction between public and private at this common-sense level. The 'public' character of the object does not reside in the fact that a single observer reports that he perceives no difference in the objects grasped by the original two, but solely in virtue of the *agreement of the several reports* of the several observers. Nor is this intended as a verbal quibble, for, unless we identify the perceiving with the reaching and grasping, no one ever perceives the content of another's perception. For, both as regards the colors and the motor responses, each perceives a content numerically different from that perceived by the others. In sum, it would seem that, for aught we can show, each observer perceives merely his own data which, as such, is always private. And, it need scarcely be added, this is true of all data, whether taken as 'psychological' or otherwise.

But if no two perceivers perceive numerically the same datum, is not the distinction between 'public' and 'private' emptied of all significance? By no means. A partial answer would be as follows. Public data are those *reported* as perceived by a plurality of observers; private data are those *reported* as perceived by but a single observer. Thus the toothache I feel is deemed my own private datum because, *and only because*, I alone report it a datum of awareness; the color of this paper is judged a public datum only because all readers possessed of normal vision affirm it to be a datum of their several awarenesses. Yet how does any one know

that others perceive anything, much less a content that is numerically and qualitatively the same to them? At most, it again might seem, only by similarity of verbal report or of other behavior. But in order to *know* this, or in order *rationally*, and not merely perceptually, to distinguish public from private data, we must supplement the latter by inquiry into the ultimate nature of the psysical stimuli that evoke the perceptions. And these, we believe, will turn out to be, not perceptual in character, but rational or inferential constructs.

That the stimuli to psychological behavior are discovered rationally, not perceptually, may seem no more than irresponsible speculation. Stimuli are still almost universally listed as 'temperature,' 'contact,' 'pressure,' 'solutions,' 'movement,' 'vapors,' 'air vibrations,' 'light rays,' etc. In the sense that these terms designate objects or events that can be manipulated in such ways as to evoke different behaviors, such classifications are useful enough. These stimuli, however, would seem, in the light of recent physical theory, to be the several psychological results of purely quantitative and configurational variations of the same ultimate reals. If matter be essentially electronic or corpuscular in character, and if the *real* physical object be some stable configuration of such entities, it follows that the *real* object or *adequate* stimulus is far removed from anything present to sensory awareness. Moreover, it would seem not improbable that all psychological behavior is the result of stimulation of receptors by physical reals that are qualitatively alike, the sole differences within which are quantitative and configurational, though the particular magnitude and configuration of electrons or corpuscles that activate one type of receptor will fail to do so in case of another and different type.

In order words, we are confronted with the distinction between the existent or perceptual on the one hand, and the real or conceptual on the other. In the domain of the former, some data are 'public' and others 'private,' in the sense that some are reported as perceived by a plurality of observers and some by but a single observer. But we need not stop here, for, if we do, then, as we have been, all data of all perceivers turn out, in light of the current causal theory of perception, to be private to the one perceiving them. Must we not, then, look to some distinction within the *real* or *rational* objects invoked as the cause of our several perceptions for the full meaning of public and private? If this be done, however, it will be found that what is truly public is not merely, not even fundamentally, some character disclosed to sense perception, but, rather, some *real* object or *rational construct* which is *inferred*, on grounds of causal necessity, to be the identical source of the several perceptions of a plurality of observers, whereas the truly private object is another such stimulus or set of stimuli likewise inferred from the results of experimental operations causally to function as adequate stimulus to but a single observer. Consider, again, the color and the pain. The physical stimulus to the perception of either is as objective as that to the perception of the other; the light rays are no more objective to the retina than are the cold air or foreign irritants to the exposed nerve of the tooth. Whether perceptual or conceptual in character, all are equally environmental to the organism and its receptors.

III. Subjective Versus Objective: Proposed Distinction

In the foregoing, we have attempted to bring to light some of the difficulties that attend the employment of the four conventional criteria in terms of one or another of which the distinction be-

tween objective and subjective is usually drawn. While each criterion is in certain respects useful, we have sought to show that, for purposes of a systematic science, there is a point at which each becomes vague, confusing and hence inadequate, or, in other words, that each criterion is itself too dependent and complex in meaning adequately to serve as the criterion that we here seek. Accordingly, we turn to the more constructive part of this paper, in which we set forth another and, as we believe, logically simpler and more objective criterion in terms of which the distinction between objective and subjective may be made, and which will at the same time confer upon psychological subject-matter and methods immunity against the charge of subjectivism, at least in any deprecatory sense of this term.

If, now, we return to the flux of objects present to awareness, uninformed by reflection and inquiry, we see that the opposition between objective and subjective is wholly foreign to it. As with other significant distinctions, that between objective and subjective will be found to be a logical or rational construct. By 'rational construct' we mean, not something that lies beyond and inaccessible to experience, nor yet some domain of noumenal 'reals' independent of and *a priori* to experience, but, rather, all concepts, meanings and entities, both formal or verbal, and empirical or perceptual, that constitute the intelligible characters of experience. By 'experience' we include not merely all objects and events, plus the relations between them, disclosed to sense perception, but also all meanings, orders, relations, entities and forces observed or inferred causally to explain, or to be descriptive of, or else structurally to constitute, no merely perceptual objects and events but conceptual ones as well.

Now it is at this *conceptual* or *rational* level that there emerges a more adequate criterion whereby we would distinguish the objective from the subjective. We call *objective* those systematic constructs which give permanent structure to experience, in which consists the unchanging character of experience, the 'one among the many' of the ancient philosophers. We ascribe to the domain of the *subjective* all that belongs to the 'here' and the 'now,' the particular, the unique and changing characters of experience.

Change and constancy, however, are relative and reciprocal to one another. A particular content is discovered to be changing only with reference to another content with which it is compared, and which at first may claim permanence for itself. Yet the possibility always remains that this content will be compared to a third, and hence may no longer be found to be the ultimate limite of objectivity reached. Since knowledge is an expanding and self-correcting process, more pervasive, more permanent, orders and relations are progressively being discovered which relegate to relative subjectivity orders and relations previously taken as objective. Thus we nowhere find two regions, one objective, the other subjective, between which some fixed line exists; in truth, the meaning of these two terms is always relative and reciprocal to one another. Thus we are always concerned with a moving limit which shifts with extension of knowledge. At a particular time, however, differences in the range of applicability of a concept may practically be taken as an absolute distinction, but only in this sense.

The reciprocal character of the distinction between objective and subjective may be illustrated in the history of scientific thought itself. In its first and most naive phase, every sensory quality was ascribed an unlimited generality of distribution. At this naive level, sensory qualities constituted the

content of scientific knowledge. But with Democritus, they began to lose this 'objectivity,' and, by the time of Berkeley, they had fallen far toward the extreme limit of 'subjectivity.' When experimental determination of the causal conditions of perceptual data was finally achieved, it was discovered that these qualities occur and exist only as the consequence of interaction between such variables as organism, brain, receptor, etc., on the one hand, and certain specific physical stimuli on the other. Both sensory data and percepts are functions of these variables, apart from which they neither occur nor exist. With reference to the context of causal variables that generate them, the content discriminated may be classed as objective; with reference to any other set of factors not causally implicated in their occurrence, the same content may be classed as subjective.

This distinction between objective and subjective may in part be described in a different manner. At one extreme, we find certain sciences, such as logical theory and pure mathematics, which concern themselves solely with concepts or meanings without reference to perceptual facts. At the other extreme, we may distinguish bare sensory modalities, or what Dewey calls 'immediate qualities of sentience,' uninformed by meaning. The first is the domain of the purely conceptual, the latter that of the wholly unique, individual and qualitative. But each of these extremes is itself an abstraction, equivalent, respectively, to Aristotle's 'pure form' and 'pure matter.' Yet empirical science is concerned with neither extreme. It cannot begin and end wholly in the domain of the purely conceptual, for then it would make no contact with perceptual data and would be by definition non-empirical. Nor can it concern itself with that which is wholly unique or purely qualitative, for, as Aristotle again pointed out, "we can have no science of accidents," of things and events each of which is wholly unique. The wholly unique, if, indeed, there be any such thing, would be wholly meaningless, incapable of any intelligible relation to anything else. Empirical science seeks invariant relations between or among perceptual data that are already to some degree meaningful as well as to some degree unique; it concerns itself with subject-matter which, once more in Aristotle's language, is *both* formal *and* material; it seeks, *i.e.*, both the formal and material causes of things and events.

Thus, as we see it, the basic distinction between objective and subjective is a function of the *reflective* or *logical* organization of experience. By experience, to repeat, we include both the content of perception and of thought. Accordingly, it will make for clarity if we consider the objectivity of percepts and that of concepts under separate heads.

1. In order to distinguish percepts as more or less objective or subjective, it will be helpful if we discriminate the meaningful or cognitive content of the percept from the sensory modalities that result from interaction between receptors and their stimuli and which evoke the meanings. Both the nature and existence of sensory modalities seem to be dependent upon two sets of variables, the structure of the sense organ and of the reacting organism on the one hand, and the character and conditions of occurrence of the stimuli on the other. The degree of objectivity of the sensory modalities will depend upon the number of specific variables discovered experimentally to be causally implicated in producing them. Suppose a given sense datum 'x' can be shown to be a function of variables *a, b, c,* and *d,* and another sensum 'y' to be a function of variables *a* and *b* only. Then 'y' is more objective than 'x.' Consider the straight stick 'seen' bent when partly submerged

in water. Because seen under special conditions of light reflection and refraction, the perceived bentness is subjective when compared to the straightness of it when seen outside the water. To the degree sensory modalities turn out to be subjective for the psychologist, to that degree they will be subjective for physical science and for the same reason.

If, however, we turn to the meaningful or cognitive content of the percept, this content will be relatively objective or subjective in terms of the range of its applicability to specific stimuli as determined by the consequences that follow from further responses and tests. Suppose I affirm yonder object to be an apple. This percept is in fact a judgment about the consequences expected or predicted to follow if I respond in certain ways to the colored shape I see. Yet the object *qua* apple is not the patch of color I see in psychological space, rather, the *apple* is the *meaning of the stimulus*, a group of other sensory modalities and responses of use expected or predicted to follow when I shake it to the ground, pick it up, bite into it, chew and swallow it, etc. Thus the test as regards the objectivity or subjectivity of a percept resides in a dimension other than that of sensory modalities.[9]

Incidentally, these considerations point to the basic distinction between veridical and illusory percepts. This distinction consists in the success or failure to experience the consequences expected or predicted to follow from further responses to the object where and as it is actually perceived. These consequences may be of any sensory modality; indeed, the greater the number and variety of these modalities that so follow, the more probable it is that the perceived content is veridical. If there is substantial agreement between the consequences predicted and those actually experienced under many or all conditions of response, the perceptual content is judged veridical; if few or no such consequences follow, the percept is judged illusory.

2. Concepts may also be distinguished as more or less objective. That concept or system of concepts may be designated as more objective which, by some operation or test, is found to be descriptive or explanatory of a wide range of phenomena (facts in all three senses above); on the contrary, that concept or system of concepts is less objective or more subjective, which, by the same criterion, enjoys a narrower range of applicability. Thus the laws of rational numbers are more objective than the law of gravitation; the law of gravitation is more objective than the law of organic evolution; the law of organic evolution is more objective than the laws of learning.

But what, now, are percepts as distinguished from concepts? Are percepts 'physical,' concepts 'mental'? Is the former a brute datum of sensory awareness, external to and unaffected by its being perceived, the latter a 'mental' and cognitive coin minted by a 'mind'? And, may percepts be distinguished into two phases, the *act of perceiving*, which is subjective and mental, and the *object perceived*, which is objective and physical? Is a percept phenomenal and a deposit of experience, a concept noumenal and *a priori*? As respects these and similar epistemological puzzles, it is highly doubtful that any analysis of them would be of profit. Three centuries of persistent effort to solve these 'problems' leave us almost as much in the dark as ever. May we not conclude that, when framed in such terms, the

[9] Thus the question as to whether sensory and perceptual data are *in* or are *properties* of a mind in contrast to something spatially and substantially disparate from it called physical, is circumvented if not indeed rendered meaningless.

relation between percept and concept is insoluble because misconceived? Indeed, we believe this to be the case.

These puzzles evaporate, however, when the relation between percept and concept is construed in functional and operational terms. Granted that percepts are concrete and existential, qualitatively, as well as spatially and temporally, discriminable from one another; granted that in this sense percepts constitute the original data of science as well as that to which all empirical knowledge ultimately refers for verification. *Yet concepts are discovered to be but percepts that assume a cognitive or logical function for understanding and control.* At the most elementary level of generalization, or, if one prefers, at the earliest level of generalized response, concepts are but class names that refer directly to some familiar domain of perceptual things and events. At more abstract levels, concepts may embrace or denote other concepts or classes of concepts. As science develops, however, the reference, or line of communication, between its basic concepts on the one hand, and some field of perceptual things and events on the other, lengthens and becomes more indirect or even lost and unknown. Hence the temptation to ascribe to each a distinct and unique metaphysical status.

Put otherwise, percepts, in so far as they are unique and individual, constitute the non-verbal or non-symbolic content to which concepts refer, in contrast to which concepts consist of meanings which confer cognitive status upon the percepts. When described in this manner, it becomes clear that the distinction between percept and concept is not antecedent to discrimination and inquiry but is purely functional to these operations. Thus the historic dualism between percept and concept, the inner and the outer, mind and matter, soul and body, the subjective and the objective, plus the whole cargo of epistemological theories advanced to account for the relation between them, turns out to be largely or wholly verbal.

Thus it is that concepts may be described as relatively objective or subjective. The wider the denotative reference of a concept the more objective it is, the narrower its denotative reference the more subjective it is. If a concept denotes no perceptual referent, it is without empirical meaning; if a concept denotes no referent of any kind, it is wholly meaningless and wholly subjective.

In general, the *simpler* its meaning, the more widely serviceable a concept is for thought, and the more objective or real it is. By simplicity is meant logical simplicity; one concept or hypothesis is simpler than another, not because it is more familiar or more easily learned than the other, but only when the number of independent elements contained in it are fewer than those contained in or implied by the other. Thus the concepts of plane geometry are simpler than those of solid geometry, because the former involve configurations in but two dimensions whereas the latter involve configurations in three dimensions. Ultimate concepts are those which, at a given stage of inquiry, possess the widest range of applicability, and which, other things being equal, are probably simplest. It is not by accident that natural science tends to identify the meaning of its basic concepts with the quantitative and mathematical characters of its subject-matter. These are among the most pervasive types of order discovered in nature. Absolute or unconditioned objectivity would be attained in discovery of orders and relations descriptive of the entire content of experience.

Thus it follows that there can be no transcendence of experience in general. Objectivity, or transcendence, in no

sense refers to anything beyond or outside the content of experience, but solely to orders and relations discovered within it. One concept may be said to transcend, or be more objective than, another when it owns a wider denotative reference than the other. The determination of this degree of objectivity, it need scarcely be added, is solely a matter for empirical investigation.

IV. APPLICATION AND CONCLUSIONS

In conclusion, we hazard a rough, tentative gradation of the main fields of scientific inquiry in terms of their relative objectivity or subjectivity as described immediately above. And, be it noted, this criterion preserves the elements of value contained in each of the four criteria examined in Part II; it avoids the confusions incidental to their use, and also provides the *most objective* measuring rod now available in terms of which *all* of the contents of experience may be classified. We begin with that which seems most objective or real, and proceed toward that which seems most subjective or least real.

1. Logical concepts and relations seem to be the simplest, the most pervasive, the most objective. The more fundamental of these are implication, affirmation, negation, consistency, independence, contradiction, contrariness and equivalence. These relations are purely verbal or formal; they obtain solely between propositions or meanings quite apart from any reference to perceptual facts.

2. The arithmetic concepts may be placed next. These, too, as well as those that immediately follow, are also formal and of a high degree of simplicity, pervasiveness, specificity and objectivity. Of these, the ordinal number series constitutes the simplest and most general type of mathematical order or relationship.

3. Next follow the geometric concepts and the more complex orders derivative from them. Of these, the Euclidean seems least objective. The discovery that it is not the concept of the line, but that of the geometric point, that is simplest and most fundamental, has led to the formulation of logically consistent systems of propositions that possess a wider range of applicability than the Euclidean. The conceptual space of pure geometry derives from concepts that are simpler and more pervasive than those descriptive of psychological space. However, s p a t i a l concepts, whether conceptual or perceptual in reference, possess in general a high degree of objectivity.

4. Next follow the subject-matter and concepts of the physical sciences, especially those of physics, chemistry, mechanics, astronomy, etc. Here, in addition to the concepts of number, point, line, etc., we find those of measuring, motion, electron, proton, neutron, positron, quantum, particle, atom, mass, energy, valence and radical among the most essential.

5. The subject-matter and concepts of the biological sciences would seem to come next. These are more complex in structure or meaning and seem to possess a narrower range of applicability than the subject-matter and concepts of the formal and physical sciences. Here, the concepts of growth, tropism irritability, ingestion, secretion, adaptation, self-preservation and renewal seem most fundamental.

6. More complex, or less pervasive still, are the subject-matter and concepts of psychological science. If it were possible accurately to delimit the field of psychology, and to specify and isolate all the variables that enter into the determination of its subject-matter, it might then be possible to list the concepts basic to psychology as natural science. This, however, we need not here attempt. We may, nevertheless,

distinguish some psychological concepts as more objective than others. The concept of response is more objective than that of intelligence; intelligence is more objective than the laws of learning; these latter are more objective than a delusion of grandeur.

7. More complex, less pervasive, or more subjective still, are the subject-matters and concepts of the social sciences. While there is much interdependence between the psychological and the social, the latter, nevertheless, seems always to implicate the former, whereas the converse seems not always to be the case. Roughly speaking, we may designate anthropology as more objective than history, history more objective than political science, political science more objective than the structure and function of American government, the law of supply and demand more objective than the price of men's hats in Kalamazoo. Both within and between these specific domains there is also much interdependence.

8. Most subjective of all would seem to be the subject-matters and concepts of moral, aesthetic and religious experience. Of all phenomena these seem to be the most complex and dependent, the most unique and individual. Indeed, we do not even begin to know all the conditions or factors implicated in these phenomena, much less the relative degree to which each operates in any particular experience or judgment of them. Moreover, it is here that value judgments enter and thereby further complicate understanding and control. Consequently, it is in these domains that we possess a minimum of knowledge and control and a maximum of confusion and opinion. Since it is in these domains that we find 'personal' factors most numerous, most influential, and least under control, it is here that we find a maximum of subjectivity.

Thus it is that we find psychological subject-matter and methods to be of a relatively high order of subjectivity. Objection may of course be raised to this use of objective and subjective. In any case, however, no comfort is vouchsafed the critic. For the moment it is seen that this use of them is purely descriptive in reference and also the most objective now available, it becomes evident that it is in this sense of them alone that the terms objective and subjective are most effectively freed of emotive, honorific and deprecatory connotations. On this ground alone our use of them is preferable to any other. In any case, psychological subject-matter and methods are relatively subjective only in the sense that they are complex and dependent, relatively individual and unique, prediction and control of which involve a comparatively large number of causal variables many of which may even yet elude detection and measurement. This, as we see it, is the sole legitimate sense in which the charge of subjectivism need disturb the psychologist.

OPERATIONISM IN PSYCHOLOGY

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I. Introduction

Operationism as a general methodological discipline, a professed scientific way of life, has attained much greater prominence in psychology than in any other of the sciences. The ordinary physicist, chemist, or biologist shows calm disinterest in operationism and operational definitions, if he has heard of these things at all, and his scientific journals contain almost no mention of the terms. Yet the psychologist, even if he is an ordinary psychologist, can hardly remain unaware of the operational movement, nor can he remain indifferent to the insistent demand that every term which he uses be operationally defined.

The operationists among psychologists trace their doctrine to Bridgman's original proposal of an operational technique of analysis in physics (5), and they represent their procedures as direct applications of the principles which Bridgman laid down. It is the purpose of this article to point out the essentials of Bridgman's operational technique and to show that the procedure adopted and applied by the operationists in psychology is something quite different.

II. Bridgman's Operational Technique

Bridgman's technique was built entirely around a single principle concerned with the concrete procedure to be followed in assigning meaning to terms or concepts. According to this principle, the meaning of a concept is understood to consist in its reference to a particular set of operations performed to determine the quantity, or to establish the identity, for which the concept stands. Each term or concept, then, is defined by specifying a corresponding set of operations, those involved in its application in any particular instance. Bridgman presented his method almost exclusively in the form of illustrative applications such as that concerning the concept of length:

> We evidently know what we mean by length if we can tell what the length of any and every object is, and for the physicist nothing more is required. To find the length of an object we have to perform certain physical operations. The concept of length is therefore fixed when the operations by which length is measured are fixed: that is, the concept of length involves as much as and nothing more than the set of operations by which length is determined (5, p. 5).

Bridgman's argument, in brief summary, proceeds as follows. In measuring nearby objects (such as the walls and floor of a room) the operations involved are manipulations of a measuring rod, observations of coincidences between points on the object and points on the scale, and calculations yielding a numerical result. Operationally analysed, a statement about the length of a wall or a floor means, and should be understood to mean, only that set of concrete operations performed in measuring the length of the object.

In measuring length in other ranges of magnitude or when objects moving with high velocities are concerned (as in the cases of interstellar distances and the dimensions of atoms or electrons) entirely different operations, optical and mathematical largely, must be substituted for the clumsy manipulations of the measuring rod. Since the operations

are different, it follows, from the operational point of view, that the meaning of length is now different, and one must be prepared to find that he cannot interchange or combine these different kinds of length. Possible differences of this nature were not recognized in the classical concepts and definitions which were based upon absolute properties of space and time. Actually, the physicists were finding so much difficulty in reconciling findings from different domains of investigation that something of a crisis existed to supply the occasion for Bridgman's proposal of the operational way out.

Bridgman credits Einstein with first demonstrating that the way out of the critical situation in physics lay in revising the old concepts so as to take account of the role of an observer in determining the results of observation. This aspect of the relativity of all observation, its dependence upon the position and procedure of an observer, is awarded explicit recognition in Bridgman's proposal that the observational operations be specified in the definition of every concept.

And that is precisely all that Bridgman proposed. Operational definitions are merely a device for insuring full understanding and communication of all the conditions surrounding observation, particularly the conditions connected with the observational procedure itself. Bridgman proposed no reform in the methods of making observations and investigating relationships between phenomena, the main business of the scientist. Again, he proposed no reform in the later steps by which the scientist utilizes his understanding of what he and others have observed. Presumably the scientist will proceed, as scientists have always done, to note agreement and contradiction in his observational results and in those of others, to draw generalizations, to formulate hypotheses, and to design problems for further investigation. The operational scientist may have gained, through his operational definitions, only the advantage of being in a position of maximal awareness of all of the conditions surrounding the observational materials with which he works.

Essentially it was a very simple thing, then, that Bridgman proposed. His operational technique is not a new method in science. It is a specific item of procedure, a formula to be followed, in defining terms or concepts in a manner designed to safeguard and to facilitate the use of the familiar scientific method. The operational technique *means* a set of concrete, auxiliary, descriptive operations to be performed by the scientist each time he uses a concept in a scientific statement. The observation of the phenomena on which the concepts are based and the discovery of the relationships expressed in scientific statements are primary operations of the scientist beyond the claimed domain of the operational technique.

Writing some ten years after presenting his original proposal, Bridgman sought to restore his central thesis to its proper place from which lofty claims and implications, conferred by followers and critics, had lifted it.

> I believe that I myself have never talked of 'operationalism' or 'operationism,' but I have a distaste for these grandiloquent words which imply something more philosophic and esoteric than the simple thing which I see. What we are here concerned with is an observation and description of methods which at least some physicists had already, perhaps unconsciously, adopted and found successful. . . . We have here no esoteric theory of the ultimate nature of concepts, nor a philosophical championing of the primacy of the 'operation.' . . . So far as it is anything definite at all, it is a technique of analysis which endeavours to attain the greatest possible awareness of everything involved in a situation by bring-

ing out into the light of day all our activity or operations when confronted with the situation, whether the operations are manual in the laboratory or verbal or otherwise 'mental.' . . . The value of an operational analysis is often to be found in the fact that it allows us to profit more easily by our general experience—our experience has shown us that certain sorts of operation are good for certain purposes. If the analysis shows that we have been mistaken in the operations which we had supposed were involved in certain concepts, as it often does, then our experience enables us to revise our estimate of the concept to accomplish what we wanted. Operational analysis is valueless without a background of experience, and the conclusions from such an analysis can have no validity which is not already conditioned by the experience (7, pp. 114, 119, 130 f.).

III. The Operationism of Contemporary Psychologists

The operationists among psychologists do not share Bridgman's modest view of the place of the operational technique in scientific method. To them operationism appears as a complete method, the new scientific method. Among the claims and promises made for operationism we find that it insures against "hazy, ambiguous and contradictory notions" and will cure the "notable instability of psychology" (15). In the Utopian operational era useless controversy will be silenced, and full agreement among all psychologists will supersede notorious dissension. The many problems arising from the heritage of dualistic assumptions can be resolved by operational translation, and the term consciousness may be dropped along with the troublesome notions of its privacy, its immediacy, and its metaphysical character. Finally, operationism supplies the basis for making good, at last, the claim that psychology is propadeutic to the other sciences, that it is truly the science of sciences (17, 18).

Apart from the benefits which it is said to bestow, the operationism of the psychologists, as it is characterized by them, appears to be identical with the operational doctrine of Bridgman. Stevens has supplied the general statements which are quoted and accepted as definitive by the other operationists.

> The principles of operationism provide a procedure by which the concepts of psychology can be cast in rigorous form. This procedure consists in referring each concept for its definition to the concrete operations by which the concept is arrived at, and in rejecting all notions founded upon impossible operations. . . .
>
> A term or proposition has meaning (denotes something) if, and only if, the criteria of its applicability or truth consist of concrete operations which can be performed. . . . Properly, a definition is the sum total of the criteria (operations) by which we determine the applicability of a term in any particular instance (16, pp. 517 f.).

This statement and the similar general characterizations by Stevens and other operationists show no deviation from the 'orthodox' doctrine of Bridgman. The operationists in psychology repeatedly refer to Bridgman and quote his statements with full assent. There is every indication, then, that the operationists regard themselves as engaged in applying strictly Bridgman's principles to the concepts of psychology.

When examples of the concrete applications of operationism in psychology are examined, however, it is clearly evident that an important difference in the actual procedure has entered. Illustration of this point may well start with some operational definitions supplied by Stevens, the arbiter of matters operational in psychology.

> . . . The term *sensation* is still widely used . . . in such a way as to lend itself to operational treatment, through an examination of the criteria which determine the word's applicability in any particular instance.

Since sensation can not refer to any private or inner aspect of consciousness which does not show itself in an overt manner, it must exhibit itself to an experimenter as a differential reaction on the part of an organism. Additional criteria for it are that it shall show a correlation with stimulation of some sense-organ and vary concomitantly with changes in the stimulus.

In the same way that *sensation* denotes a class of reactions which satisfy certain criteria, *attribute* of sensation denotes a sub-class which satisfies more restricted criteria. We find operationally that when we present a given stimulus to an observer we may get a discriminatory reaction in terms of any one of several aspects of the stimulus, depending upon the attitude of the observer. Therefore, we apply a different name to each of these several classes of reactions.

The specification of the attributes of sensation in a given sensory modality and the establishment of adequate criteria for them are contingent upon experimental discoveries. Thus, in the case of audition . . . it is possible to hold one attribute constant and vary all the others. By this procedure four aspects of tone, pitch, loudness, volume, and density, have been determined as satisfying the criteria of tonal attribute. These criteria are:

1. A tonal attribute is a response elicited from a normal observer. . . .
2. It is obtained with pure tones. . . .
3. It shows continuous variation when one or both of the dimensions of the stimulus is varied. . . .
4. Every attribute is a different function of the two dimensions of the stimulus, frequency and energy. . . .

The class of reactions which we call *attributes* is obtained from organisms which have been 'set' or 'tuned' so that they respond to a certain aspect of the stimulus-process. This tuning of the observer is one of the fundamental operations underlying the concept of attribute. . . .

In general, the procedure is as follows: We note that organisms make differential responses to stimuli and we call these differentiations by such names as *pitch, density, saturation, hue, extent,* etc. Then we find that we want another organism to make similar differentiations, so we proceed to persuade it, by words or by a system of reward and punishment, to react until it performs the differentiation which we seek. When it does, we conclude that it has achieved the proper 'set,' for the operational test of the subject's attitude is the particular class of response he gives, and the mode of variation of that response as a function of the stimulus (**16**, pp. 523–527).

The reader who comes to these psychological definitions fresh from Bridgman's examples of operational definition senses something unfamiliar and finds himself uneasy in attempting to assimilate the new examples. Critical examination and comparison reveal the fact that there *is* something new and different in the operational definitions of psychological concepts. The operations specified to define the meaning of psychological terms are operations primarily involved in *producing,* in *eliciting,* the phenomena referred to, whereas in the case of Bridgman's definitions, the operations involved are those of *measuring* the quantity or *testing* the identity of the phenomena.

The operations which Stevens uses for the purpose of definition are the operations of the laboratory by which conditions are provided for the occurrence of a phenomenon and changes in these conditions are introduced to produce variation in some aspect of the phenomenon. The operational definitions of Stevens are stated in terms of correlation with stimulation, concomitant variation with changes in the stimulus, dependence upon dimensions of the stimulus, elicitation from normal subjects, use of pure tones as stimuli, mode of variation of the response as a function of the stimulus, elicitation from organisms which have been set or tuned. Such terms all refer directly to, or imply, operations of setting up and manipulating antecedent conditions to which certain consequent

phenomena are functionally related. The consequent phenomena are then defined by the essential antecedent operations. To correspond with this pattern of operational definition, the definition of a physical object (such as the floor of a room) should consist of operations essential for producing the object, and the length of such an object should be defined by operations effective in increasing or decreasing length. The analogy is better if the length of an organic structure (such as the height of a man) is defined operationally in the manner of the psychological definitions; length, in this case, involves an elaborate set of operations connected with the conditions which affect growth. For Bridgman the length of a floor and the height of a man are operationally defined by the operations of measuring the object.

In psychology it is the almost uniform practice to formulate operational definitions in terms of operations necessary for producing, or effective for varying, the phenomena defined. Frequently the actual terms of the definitions refer to environmental conditions in a manner to imply the operations involved in providing these conditions. Other operationists supply numerous examples of operational definitions similar in pattern to those of Stevens.

Skinner (14) supplies many straightforward examples of operational definitions which fit the pattern characteristic of operationism in psychology. He deals with concepts representing entities and classes which cannot be distinguished in terms of any present properties—the operations of measuring and testing yield only ambiguous results. Such entities and classes, which might be considered purely nominal, are operationally defined by Skinner in terms of the experimental conditions necessary to produce them, and they are then given a place of first importance in his scientific thinking.

> An observation of the state of a reflex at any given time is limited to its strength. Since the data are changes in strength and therefore the same in all dynamic laws, the system emphasizes the great importance of defining and classifying operations. The mere strength of the reflex is itself an ambiguous fact. . . . The strength of a reflex at any given time is a function of all the operations that affect it (14, p. 25).
>
> Except for its dependence upon reinforcement, the conditioned reflex behaves with respect to other operations just as any other reflex. . . . All reflexes are subject to experimental modification in strength. The change in strength called conditioning is distinguished merely by the specific operation that brings it about (14, p. 61).
>
> The process of conditioning is distinguished by what is done to the organism to induce the change; in other words, it is defined by the operation of the simultaneous presentation of the reinforcing stimulus and another stimulus (14, p. 19).

Tolman (19, 20) recognizes three kinds or classes of operations in terms of which operational definitions may be constructed. Included is the class of operations concerned with production of the phenomena—concerned with relations to 'the controlling independent variables'—, and this class figures prominently in his definitions of specific concepts.

Tolman states that his "operational behaviorism . . . asserts that psychological concepts, *i.e.*, the mental capacities and mental events, may be conceived as objectively defined intervening variables. And it asserts that these intervening variables are to be defined wholly operationally—that is, in terms of the actual experimental operations whereby their presences or absences and their relations to the controlling independent variables and to the final dependent behavior are determined" (19, p. 102).

Among the intervening variables listed by Tolman are 'demand,' 'appetite,' 'dif-

ferentiation,' 'skill,' and the like. Each of these concepts is

> . . . capable of a perfectly objective definition and measurement. . . . Each is depicted as resulting from its own correlative environmental variable plus the controlling effects of heredity, age, previous training, and special endocrine, drug or vitamin conditions. And . . . each such 'intervening variable' is defined by a standard experiment in which its correlative independent environmental variable is systematically varied. . . . Under such conditions the resultant variations in the behavior-ratio are, *by definition,* to be said to mirror directly the variations in the one given intervening variable.
>
> For example, the intervening variable—'demand'—(say for food) shall, by definition, be measured by the variations in the behavior-ratio which occur in a standard experiment when . . . all the independent variables other than 'maintenance schedule' are held constant at certain 'standard' values while the maintenance schedule itself is systematically varied. The sort of results one would get are shown in a figure in which a curve of demand-values is plotted over a scale of hours-since-feeding. And having, thus at last, this curve—this function—between 'maintenance schedule' and 'demand' one would use it for defining the to-be-assumed value of the demand for any given value of maintenance schedule on all future occasions (20, pp. 16–18).

Tolman exhibits here the same kind of operational procedure as is shown in the definitions of the other operationists, although his defining operations are more difficult to identify. His intervening variables are 'constructs' connected by a set of functions to the independent variables in the one direction and by another set of functions to the resultant behavior in the other direction. He attempts to define the intervening variables 'by going at them experimentally, *i.e., operationally,* from the two ends.' His actual operational definitions amount to the specifying of operations performed upon the independent variables to produce certain results in the final behavior. For example, when he defines the quantitative aspect of (assigns a value to) a demand for food, he uses, as defining operations, the operations of witholding food for a certain number of hours during the course of a standard experiment. The antecedent variables themselves are defined in terms of previously performed experimental operations (or historical processes) involved in setting up the to-be-assumed conditions of the organism. Heredity is defined in terms of combinations of the traits of ancestors as represented in breeding charts. Age is defined by the elapsing of days and hours after birth. Previous training is defined by the complete record of previous trials or performances.

Pratt (13) criticizes and rejects many of the claims and some of the special theories of the operationists, but he remains a vigorous advocate of the operational method. In considering the meaning of concepts, Pratt seems to think of scientific meaning as primarily consisting in, or as revealed by, correlations and functional relations. His operational definitions, then, incorporate operations performed upon the antecedent terms of the function. And his definitions conform to the general pattern of the psychological definitions which we have been considering.

> . . . it is possible to define sensation logically in terms of the operations performed in arriving at stateable relations between the controlled aspects of the stimulus and the correlative reports (13, p. 15).
>
> A reflex is a definition, given in terms of the number and kind of analytical procedures required to make possible a statement of the functional dependence of common response-features upon stateable stimulus-conditions (13, p. 16).

The foregoing examples, contributed by leading advocates of operationism, demonstrate the model of operational

definition in psychology. Numerous other examples of the same type of definition can be found readily by consulting, practically at random, recent books and articles on almost any psychological topic.

To the operationists among psychologists, the technique of operational definition *means*—it is applied in any specific instance by—specifying the operations necessary to produce phenomena for which a concept stands. That this is not what Bridgman originally meant by operational definition has been argued on the basis of the nature of his model definitions of physical concepts. The argument needs final support in the form of examples of operational definitions of psychological concepts constructed according to Bridgman's model. Such examples are extremely difficult to find in the psychological literature. Tolman alone among the operationists is helpful here. One set of Tolman's definitions stands in striking contrast to his other definitions and the definitions of the other operationists.

> The final dependent behavior has three component aspects. . . . They are (*a*) *direction*, (*b*) *quantity* or *persistence*, and (*c*) *efficiency* or *skill*. That is, concretely speaking, a behavior is (*a*) a doing of one thing, a taking of one direction rather than another: it is speaking certain words rather than other words, sitting in a chair rather than walking about, going into one maze-alley rather than another maze-alley, or the like. And it is (*b*) a taking of this direction with a certain degree of intensity or persistence as measured concretely in terms of percentage of animals in the given situation who do it, or by the amount of distraction that has to be introduced before it is interrupted, or by some other quantifying technique. And it is (*c*) the exhibition of a certain degree of efficiency or skill as measured by time, waste motion, or some similar measure (**19**, pp. 92–94).

These are operational definitions unmistakably modeled after the definitions of Bridgman. The operations referred to are identifying, testing, and measuring operations instead of the producing or eliciting operations specified in the previously examined psychological definitions. The operations are applied in the present to establish the identity and to determine the quantity of phenomena already independently produced or elicited by antecedent operations which do not come into the definitions. These definitions exemplify what Bridgman evidently meant by the technique of operational definition.

Boring certainly belongs among the operationists, and this is, perhaps, the point at which he best comes into our discussion. In his connections with operationism, Boring has been concerned with broad theoretical matters, the reduction to an operational basis and the operational restatement of general problems, theories, and axioms. His operational thinking occurs in elaborate systematic contexts from which particular passages can be extracted only at the risk of seriously distorting his full views. Our immediate interest is in finding where he stands with respect to the particular issue between Bridgman and the psychologists concerning the choice of defining operations.

Boring assigns special importance to the one operation, differential response, as does Stevens. He does not go along with Stevens, however, to define differential response in terms of functionally connected antecedent variables or operations. What Boring does is to make use of differential reactions as the defining operations which establish the occurrence and nature of antecedent neural phenomena.

> Discrimination . . . can be understood as the differentiation in a consequent system that adequately reflects the differentiation in a prior system (**3**, pp. 460 f.).

A subject who asserts the occurrence of a specific 'experience' actually is indicating the occurrence of a specific neural event antecedent to the assertion (4, p. 459).

Boring appears to be definitely on the side of Bridgman. The operations to which Boring refers are clearly subsequent operations by which the existence and nature of phenomena are established rather than antecedent experimental operations by which phenomena are produced or elicited. And yet, Boring's operations are not analogous to the defining operations around which Bridgman's operational technique is built.[1]

[1] The operational restatement by Boring of Müller's first axiom (quoted above) can be transposed to fit precisely the form of Bridgman's definitions, to read: The occurrence of a specific neural event is defined by—is established by—the concrete operations, on the part of a subject, of asserting the occurrence of a specific experience. Boring, of course, does not present his restatement as his definition of a neural event, but the operational definition implied is a somewhat shocking one to the conventional psychologist. The conventional concept of neural events is one of tangible, physical events identified and measured, presumably, by physical operations performed with scalpel, microscope, and galvanometer. It is the explanatory appeal of this concept of the real 'underlying bodily processes' which generations of psychologists have been able to exploit in accounting for the occurrence of experience. Boring brings in the conventional concept by adding an account of how neural events can be known about also by the physical operations of the physiologist, by 'tapping into the systemic series at other points.' According to Bridgman's dictum, a change in the underlying operations necessarily changes the meaning of a concept, and only as long as the different operations yield the same results can the concept continue to be used unambiguously. There is the possibility, then, that when Boring establishes neural events by the operations of reporting experiences, he means by neural events something different from what the physiologists, the isomorphic parallelists, the conventional psychologists, and he himself (in other contexts) have meant by the concept. Boring recognizes this possibility, but he seems fully confident that the results from the different operations can be combined and interchanged within the meaning of a single concept of neural events.

The operations which enter into Boring's statements and figure in his thinking constitute one of the two principal terms of a primary function; the operations are the consequent events which follow a set of antecedent events in the manner expressed by the function. The operations with which Bridgman deals are subsidiary operations applied from outside to the principal terms of a primary function for the special purpose of defining these terms. Boring's procedure is operational in that he establishes the existence or identity of phenomena in terms of events rather than absolute properties, but these events regularly follow or result from the phenomena whereas Bridgman's operations may be (or may not be) applied without entering into or disturbing the sequence of primary events. Boring establishes the occurrence of a specific neural event by reference to subsequent assertion of a specific experience, whereas Bridgman could be expected to regard this kind of functional relationship between primary events as a major scientific proposition or law embodying concepts whose meaning should be established by the technique of operational definition. And by operations Bridgman would mean in this case testing and measuring operations applied to identify and measure both neural events and assertions of experiences.

What is true of Boring's conception of operational procedure can now be seen to apply also to the conception of the large group of operationists to whom an operation means an essential antecedent condition or event for producing a phenomenon. It holds for all of the operationists in psychology in that they mean by operation a principal event which stands as either the antecedent or the consequent term in a primary func-

tion. This leads to the characteristic pattern of operational definitions in psychology in which the meaning of psychological concepts is stated in terms of either the operations performed to produce phenomena or in terms of the events resulting from phenomena. And this procedure which the operationists in psychology have adopted is not, we have tried to show, the operational technique as it was designed by Bridgman.

IV. PSYCHOLOGICAL OPERATIONISM AS A SCIENTIFIC METHOD

Bridgman envisaged the application of his operational principle to concepts in various fields, but for him the technique in any application remained the same concrete procedure for defining concepts. His technique is operational by virtue of its utilization of actual testing and measuring operations exclusively in defining the meaning of concepts. Operationism in psychology constitutes an entirely new method in science—a method designed to supersede, rather than to supplement and improve, the familiar method of science.

The operationism of the psychologists is essentially a method which *dispenses with* the operations of defining concepts. The most striking feature of this new operationism is its fundamental conception of what constitutes operational meaning, a conception which, in effect, abolishes the very occasion and the purpose for which Bridgman designed his operational technique. In the usual way of thinking, the concepts of operational psychology are not defined at all; the phenomena for which the concepts stand are not identified. Concepts merely appear in statements or equations specifying functional relationships, and they mean nothing more than these functional connections. Phenomena result from, or produce, other phenomena, and for the operationist no further identification beyond the statement of one of these primary functional connections is necessary or desirable. Hence, an operational concept in psychology may stand for a class of phenomena admittedly unidentifiable by any present operation of testing or measuring. Such is the operational concept of the conditioned reflex which is indistinguishable from an ordinary reflex except by the fact of its functional dependence upon the presence of a reinforcing stimulus among the essential antecedent conditions (11, 14). For meaning as ordinarily defined, and for meaning as specially defined by Bridgman's testing and measuring operations, the operationists substitute a new kind of meaning, purely functional meaning.[2]

As a method in science, the operationism of the psychologists attempts to abbreviate, by omitting the usual process of definition, the series of operations involved in scientific procedure. The established method in science leans heavily upon definition at every step, and this remains true even when Bridgman's operational form of definition is adopted. The establishment of laws of functional relationship between events, generally recognized as the main concern of science, ordinarily proceeds under the assumption that the principal terms of the relationships can be independently defined, that is to say, that the events can be separately identified. The operationists in psychology attempt to proceed directly to the statement of functional relationships between events not identifiable apart from their functional connections.

The operationism of the psychologists involves a fundamental change in scientific method, a change affecting basic as-

[2] The term *functionalism*, apart from its historical association with another school of psychologists, seems much more appropriate as a name for the present methodological doctrine than does operationism. Actually, the present operationism shows many interesting points of similarity to the earlier functionalism.

sumptions. Such a change naturally raises important theoretical considerations and entails the solution of practical methodological problems. These are matters for the operationists, not for the present authors, to deal with, but a few of the most obvious practical questions may be mentioned here by way of illustration of the truly revolutionary character of the new operationism. In referring to operational procedure and operationism we shall now mean the method of the operationists in psychology, not the technique of Bridgman, and we shall have in mind particularly the brand of operationism which defines a phenomenon in terms of the operations involved in producing that phenomenon.

How will the thoroughgoing operationist get started upon the investigation of a problem? The operationist is apparently in agreement with other scientists upon the point that the solution of a problem in science consists in the establishment of functional relationships between events. Events, according to the operational conception, are to be identified in terms of their functional connections. Unless he already knows the functional relationships, the operationist cannot formulate his problem in the form of a question concerning the functional connections of a certain set of events because a certain set of events is not definable or identifiable until the answer to the question is known. He cannot try out various combinations of stimuli to see if they elicit the phenomenon under investigation, for he could tell whether or not it was elicited only by reference to operations performed to elicit it. Nor can he, in the usual manner, vary the stimulus-conditions independently one at a time to note the effects. He should have nothing to note except the operations of varying the conditions themselves which, according to the logic of his method, constitute the only operations for identifying any effects which might occur. And a case in which a certain stimulus-variation might produce no effect is ruled out entirely.

Questions arise as to how such a strictly operational psychologist might ever be able to discover psychological phenomena and their functional connections in the first place. Unless he can specify the operations effective to elicit a reaction, he cannot identify that reaction, and having specified a set of effective operations, he can go no farther in characterizing 'the reaction elicited.' How could Skinner have discovered a conditioned reflex (or the change in a reflex called conditioning) which "is distinguished merely by the specific operation that brings it about" (14, p. 61)? When he had performed that specific operation, how did he know it brought something about? Operationally considered, this last is a meaningless question unless the answer is that he knew it brought about a result, by his having performed the specific operation for bringing about the result. If the performance of an antecedent operation establishes the occurrence of a specific consequent, then the performance of any number of separate operations, whatever their nature, must establish the occurrence, and fix the identity, of a corresponding number of separate phenomena. The real question, then, seems to be that of how an operationist might ever be able to avoid discovering innumerable phenomena, one for every separate operation which he might perform.

How can an operationist make of his scientific knowledge anything beyond a huge collection of separate and completely unrelated items? If each phenomenon is defined solely by its unique set of functionally connected operations, then it cannot enter into functional relationship with any other operation unless it thereby lose its identity. Con-

sidered from this operational point of view, the statement that different antecedents may produce the same result, or a similar result, is a meaningless statement. For example, a statement that some other operation could produce, influence, or extinguish the process of conditioning is meaningless if conditioning is a change which can be distinguished only by the operation of introducing a reinforcing stimulus. Similarly, questions as to whether the same neural event might be the antecedent condition for a subject's reporting the occurrence of experiences similar to or different from a specific experience, or for his reporting nothing, are meaningless questions if a specific neural event is defined strictly in terms of the occurrence of a specific assertion of experience.

The operationists among psychologists do, of course, get started upon investigations which they carry through to successful conclusions: they discover psychological phenomena and establish their functional relationships to other phenomena, they incorporate their findings into broad theories and integrated systems. They accomplish these things by following the usual scientific method, and their occasional excursions into sheer operationism do not interfere seriously with their scientific work. It has been argued here that the kind of operationism exhibited by these operational psychologists should, if applied strictly and consistently, require a revision of basic assumptions and drastic changes in actual methodological practices. It has produced no such important results in psychology because the operationists have merely grafted the new method upon the old methodological base without serious regard for the resultant structure.

In the critical matter of definition, the operationists do not actually rely upon their functionally connected operations alone to identify and distinguish phenomena. They start with a heritage of already identified variables, entities, and events, and for these they adopt the established definitions or supply working-definitions of the ordinary kind. They have acquired from Bridgman a distaste for definitions referring to properties, and they have themselves cultivated a strong distaste for all kinds of 'mental' operations. As long as simple measuring operations can be applied, the operationists' method is no different from any other objective method of the type long advocated in psychology by the Behaviorists. It is only when the simple measuring operations cannot be performed or when they yield ambiguous results that the operationists resort to their use of functional connections as defining operations. By the use of this device they presume to establish the existence and determine the identity of hypothetical phenomena which are otherwise unidentifiable and indistinguishable.

The operationists appeal to the arguments of Bridgman to justify their procedure, but the particular arguments to which they refer are uniformly those advanced in connection with the simple technique of operational definition in terms of measuring or testing operations. Bridgman recognized the usefulness of hypothetical constructs, and he produced a special technique for distinguishing useful from meaningless constructs and for ascribing physical reality to some while denying it to others. The constructs with which Bridgman's logic is concerned are not, however, the same kind of constructs as those devised by the operationists.

The device of the operationists for establishing the existence and the identity of primary phenomena by stating their functional connections is a major innovation in scientific logic. The logical and methodological implications and consequences of the purely functional

operationism which has appeared in psychology need to be fully explored before the technique can be justified as a valid scientific procedure.

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PSYCHO-GEOMETRY OF ORDER [1]

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I. Introduction

The world is a panorama of many different forms—and man has always wondered just what relationship exists between form, per se, and his psychological processes. It is obvious that some forms can be remembered, whereas others cannot be remembered without difficulty. Some are pleasing to the senses, others are unaccountably ugly. Some can be easily seen, and again, others are extricated from their contexts only with intense study.

Form can be roughly defined as the exterior aspects of the geometric conditions of a body. But just how is man 'hooked up' psychologically with geometry that these objective geometrical differences will bring about subjective psychological differences?

The attempted solution of this problem has motivated philosophy since the days of Empedocles and Aristotle, and a discussion of its development would be entirely too lengthy for a disquisition this size. Suffice it for us that the first truly scientific enquiry was that of Ernst Mach (5). His was a pioneer attempt to analyze, in their own right, these psychological differences caused by geometric differences. Mach approached the problem from the physiological angle, and concluded that the geometrical congruity of figures is determined by all the homologous lines being proportional. However, to obtain optical similarity, he noted that "all their homologous lines must be parallel or, as we prefer to say, have the same direction" (5, p. 48). Recently, Sickles and Hartmann examined the problem of psychological order—also a part of the historic problem of form—and their geometric analysis led to the conclusion that order was directly dependent upon the degree to which "lines tend to become parallel with each other and the vertico-horizontal coördinate system natural to the organism" (10, p. 411). Thus Mach, dealing with an isolated case of psychological order, came to much the same conclusion as Sickles and Hartmann in their geometric analysis of the question. The former did his work from the physiological angle, and interpreted his results in the light of physiology. The latter authors associated their findings with electromagnetic theory—Sickles (9) having previously found a geometric identity between the characteristics of visual and electromagnetic fields.

Only four years after the publication of Mach's *Analysis*, Christian von Ehrenfels (1) delved into the Order question from an auditory standpoint, and his results led him to announce that in the realm of auditory perception, the identifying form-character of a given percept was dependent wholly upon the over-all pattern or order into which the individual component parts were arranged temporally—and not upon these parts themselves.

Following Ehrenfels, a great number of experiments were performed in the further attempt to unearth the basic factors behind the problem of form and psychological order. Out of this work a vast bulk of theoretical agreement and differences arose—the sum total of

[1] This paper is a further development of W. R. Sickles & G. W. Hartmann, The theory of order. Psychol. Rev., 1942, 49, 403–421.

which became identified by the name of *Gestalt* Psychology. Among the experimenters involved, the names of Wertheimer, Koffka, and Köhler stand out prominently—for it was really this group, working in Berlin, which brought the whole subject to the fore. Wertheimer (12) particularly is given credit for having opened the subsequent battle with an experiment on what became known as the 'Phi-phenomenon'—and his paper was calculated to destroy the traditional eye-movement hypothesis which had found origin with Hering and emphasis with Wundt—the same theory whereby Mach had interpreted his findings in the problem of form.

Since the development of Gestalt psychology, other 'non-Gestaltists' have added din to the resulting battle with experimentation upon divers phases and points of theoretical difference—it being realized that this 'new' psychology bid fair to entirely alter the existing theories. Among this group of opponents, we find such names as Moore (6), who questioned the principles derived by Wertheimer; and Foley (2), who attacked the influence of context upon perceptual differentiation. A year after Foley's publication, Purdy (8) conducted experiments in 'The structure of the visual world,' and these experiments convinced him that some unknown and undefined single principle lay behind the whole controversy (a conclusion also reached by Foley), and not many individual unexplainable principles such as those of Wertheimer. Musatti (7) came to a similar conviction, as did Vernon (11).

This unknown and mysterious determinant factor, found by the above 'non-Gestalt' investigators, is believed by Sickles and Hartmann (10) to be nothing more than the concept of Order, as analyzed and defined for the first time by them. This is further borne out by the close correlation to be found in the conclusions of the above 'non-Gestaltists,' who worked independently. The particular name given for this factor, by each of the above, is as follows: 1. The factor of Compactness—Foley; 2. The tendency for formal monotony of Structure—Purdy; 3. The law of minimum variations—Musatti; 4. ". . . the mutual relationship . . . in the mysterious organization known as 'form,' 'structure,' or 'configuration' which is the essential objective determinant"—Vernon; 5. Order—Sickles and Hartmann.

II. THE STRAIGHT LINE

The psychological phenomenon of order is defined as being produced by and directly dependent upon straight lines (10). Now it is realized that, aside from human constructs, this is a relatively rare geometric attribute of existentials. Nevertheless, our world is one composed entirely of interrelated and interacting forces, all of which reveal a preference for straight line action. Further, the earliest evolutionary form of organized behavior was the tropism, proved long ago by Jacques Loeb and others to be a 'straight line reaction' to straight line forces, and dependent upon the symmetry of the organism involved. The value of the straight line for the theory of order, however, lies in the fact that it is the manner wherein an electromagnetic field acts, regardless of how curvilinear the determinant current may be.

With respect to the forces which constitute the known world, a straight line may be defined by the following theorem: ***the path of least resistence taken by any force through any constant medium between any two points, is said to be a straight line.*** Because space is a constant medium within the limits of human activity, the straight line is also the ***shortest distance*** between any two points—the characteristic whereby Eu-

clid defined it, and which would not be true were the above theorem false.

A straight line is the only uni-dimensional factor in geometry, and consists of nothing but direction. Now Mach divided the sensations of sight into two classes, inseparable from each other. One was color-sensations, the other space-sensations; and this latter he defined as being determined by the *direction* of lines, stating that space-sensations "yield us information concerning the likeness or unlikeness of directions and equality or inequality of spatial dimensions" (5, p. 49). However, all directions and dimensions are judged relative to a coördinate system. Without this system, these two factors given by Mach are identical. Since parallels are lines having the same direction, 'likeness or unlikeness of directions' is nothing more than the degree of parallelism they possess. As for Mach's other factor, 'spatial dimensions,' we realize that *any dimension (or distance) along any axis of any coördinate system is a function of direction when judged from any other axes, i.e.*, when the *distance* of a point varies on the Z axis, its *direction* from any other point (except those constituting the Z axis) varies proportionately. If distance were not a function of direction, one could never solve a triangle trigonometrically. Consequently, 'equality or inequality of spatial dimensions' is just another way of saying 'likeness or unlikeness of directions'—and by the same token, boils down to 'degree of parallelism relative to a reference system.' And such a rewording would be almost identical with the definition of *order* given by Sickles and Hartmann (10).

We find Mach declaring that the straight line has a sameness of direction in all its elements which makes it the simplest as well as the most probable of all psychological dynamic action-paths. He goes on to say, moreover, that "it is to be noted that every point of a straight line in space marks the *mean* of the depth-sensations of the neighboring points. Thus, the straight line in space represents a *minimum of departure from the mean of the depth-sensations;* and the assumption forthwith presents itself that the straight line is seen *with the least effort*. The visual sense acts, therefore, in conformity with the principle of economy, and, at the same time, in conformity with the principle of probability, when it exhibits a preference for straight lines" (5, p. 96).

Further, Mach was convinced that this preference for straight lines is "not a result of individual functioning, but that it is also characteristic of animals, and is, at least in part, a matter of inheritance" (5, p. 96). The very hodge-podge nature of man's environment helped decide the straight line as the only possible psychological unit of space-perception. Because the forces comprising the world act in straight lines, whenever man sets his environment in order (so necessary to memory), or builds such objects as houses or roads, straight line arrangement and construction make for durability. Not alone his social determinants, but his entire evolution was geometrically limited by just such forces, for man has been a moving animal traveling through an environment which differed widely in detail. If he developed at all, this development had to be determined by those factors common to all details and types of environment. These environmental constants were sunlight and gravity, and both act in straight lines. The earliest organized behavioral reaction, therefore, was the tropism—a 'straight line reaction' to straight line forces, and dependent upon the symmetrical shape of the organism. Further, since symmetry was a necessary geometric element in this development of organized behavior, the following theorem defines a highly

valuable characteristic: *the straight line is the only division of an area which can result in symmetry.*

Intelligence involves configurations with either or both the visual and mental images. If these images were constructed on any other basis than that of the straight line, mental action would be impossible, not only for electrodynamic reasons, but also for reasons of logic. *The straight line, because it is uni-dimensional, is the only unitary form with which definite relative position can be obtained in any direction in any plane.* The sole alternative is the curved line, and here the degree of curvature enters into the question. Curved lines, whether viewed singly or grouped, necessitate the use of two dimensions for any localization whatever. They can give definite relative position only when grouped with the same curvature in the same direction in the same plane. This definite relative position of points is necessary if any spatial classification, order, localization, or constancy of position is to exist—and without these factors, both perception and reasoning would be manifestly impossible. Just how could the human being deal with a universe composed, as it is, of a conglomeration of meaningless points, some distant, some close, if it did not see in these points various lines and shapes? Throughout the world, from galaxy to atom, the connections between different bodies have always been, by dint of their very existence, invisible straight lines of force. The intellect demonstrates the ability to group these bodies. Shall we assume that the psychological interpretations of these straight line connections are anything else than straight lines?

William James noticed that points in space have no significance in themselves. The lines subjectively constructed between these points constitute all sensations of relationship between bodies not objectively connected. He says: "When we speak of the relation of the direction of two points toward each other, we mean simply the sensation of the line that joins the two points together. The line is the relation; feel it and you feel the relation, see it and you see the relation; nor can you in any conceivable way think the latter except by imagining the former (however vaguely), or describe or indicate the one except by pointing to the other" (3, p. 149).

III. THE COÖRDINATE SYSTEM

All human judgments are relative to standards intrinsically given or arbitrarily selected. This is axiomatic. We say that a thing is heavy, but we mean 'heavy with respect to the maximum of our lifting ability.' We say that ice is cold. It is understood that we are comparing the temperature of ice with that of ourselves or our surroundings. Ice is definitely *warm* if compared to liquid air. The same is true of judgments of motion, position, direction, distance, and size. These are spatial attributes which do not exist, as such, in the external world. Like the crystallization of ice, existence is intrinsic, but like the judgment 'cold,' spatial judgments of any character whatever are relative. If, then, the human being makes such judgments, a study of sensory perception must necessitate a study of the reference system—the only possible standard whereby spatial judgments can be made.

Now space, both subjective and objective, is tridimensional, and *the cartesian coördinate system is the only perfect directional division of this space.* It consists of three perpendicular straight lines such as are found where the edges of a cube meet at one corner. It should, however, be remembered that by the terms coördinate or reference system, we do not mean merely three intersecting directions, but rather, the

spatial conditions of which these directions represent the mean, conditions in which equal positions relative to these axes have equal value. And it is considered highly significant, and direct evidence of the character of perception, that *only two such types of thoroughly organized space are known to exist—that of visual space, and that of electromagnetic fields.* This fact is much more proof of the electromagnetic character of visual space than all the experiments that have been or can be performed. Sickles (9), in an experiment on the distortion in the Ponzo illusion, found that there was even a *direct proportionality* between the progressive visual distortion of the Ponzo field and the calculated progressive electromagnetic tension-difference in an electrical field identically structured.

Since the reference system is composed of physicogeometric conditions represented by three perpendiculars, any examination of this system involves the examination of the perpendicular as regards geometry, physics, and psychology. It can be defined by the following theorem: *the path of least resistance taken by any force through any constant medium from any field of equal tension, is said to be a perpendicular.*

It will be immediately seen that this is merely a further differentiation of our definition of the straight line. Since space is a constant medium, and matter is composed of electricity which invariably determines a field of tension, a perpendicular is also the *shortest distance* from a point to a line or plane—which, as in the case of the straight line, would not be true were it not for the validity of the above theorem. Geometry grew out of observations in visual space, built of electricity, and is dependent, therefore, upon the dynamic and geometric action-laws of this force.

As previously explained, the earliest evolutionary form of organized behavior was the tropism—dependent upon the symmetry of the organism involved, and even today, much of the organized behavior of the human is dependent upon the symmetry of his body. Therefore, the significance of the following theorem can be easily grasped: *the perpendicular is the mean of symmetry, i.e., it is the only line which can be drawn from a point to a line or from a point to a plane, which will not have one or more symmetrical equivalents.* Because the perpendicular is the mean of symmetry, the following is an important corollary of the theorem: *the perpendicular bisector of any diameter of any laterally symmetrical figure, is also the bisector of all other diameters, and bisects the area of the figure.* To realize the biological and psychological value of this corollary, one need only examine the phylogenetic development of the nervous system—or the segmentation of early life forms.

Due chiefly to Faraday and Maxwell, the emphasis in the study of electrical processes shifted from the conductors to the structure of the surrounding dielectric medium—the field of tension, and the charges on the surface of the conductor were looked upon as being merely the free surfaces of the medium. Now, according to the theory of order, the geometry of this medium is exactly that of the visual world, and the most unique characteristic of the electric current (making it especially suitable for psychological action) is the instantaneous creation of a highly organized medium or field of tension. Thus, *the electric current is the only uni-dimensional force which automatically and instantaneously creates a tri-dimensional condition of tension expressing a preference for the perfect reference system—the cartesian coördinate system of three perpendiculars. The intensity of any point in this highly unified field is rela-*

tive to this geometric system and can be calculated mathematically.

The most puzzling problem presented by the visual field is its spatio-temporal organization and constancy. Though it is built of sensations received in a staccato fashion, it is nevertheless unified throughout and constant. Further, though the retinal images are necessarily bi-dimensional, this visual field itself is tri-dimensional. Every point blends imperceptibly with every neighboring point until no break can be found in the continuity of the whole. Even the 'blind-spot' is filled in. In other words, it is a spatio-temporal continuum. Over and above all this, every point in the visual field has a definite positional and directional value relative to the field as a whole. It is up, or down, or left, or right, as measured from the center of attention, the foveal center, and the general axes of the body. And to make any investigation of visual space even more enigmatic, we find that this entire structure, with all its unity and constancy, can be destroyed, shifted, or set up merely by moving the eyes. This occurs almost instantaneously, and the new field has all the attributes of the old. Not even the shift produces a break or gap in the continuity.

From the above characterization of the visual field, it can be readily recognized that only one force could possibly be responsible, *viz.*, the electromagnetic field—which has all these attributes, including the innate reference system.

There is a simple means whereby we can obtain direct experience of this reference system and its directions. If one gazes straight at a light of medium intensity situated at such a distance that all glare is eliminated, and lowers his eyelids until the shape of the light and its surroundings blur and become indefinite, a strange phenomenon will take place. From the fovea, as center, *the light will seem to shoot out in relatively horizontal and vertical directions!* The effect will be still more pronounced if the eyes are damp with tears or some other fluid to cause greater diffusion of light. To prove that this 'plus-sign phenomenon' is not dependent upon the nature of the light or the background, the head can be tipped to either side, and the directions of radiation will also tip.

A few years ago, Kurt Koffka (4) came to the conclusion that the innate positional and directional values possessed by the various points of the visual field necessitated the supposition of some sort of 'frame of reference' which must be based upon the vertico-horizontal directions intercepting each other at the center of attention. Mach (5) had previously reached the same conclusion. In fact, the works of both these experimenters, as well as others, are filled with evidence for the existence of the vertico-horizontal coödinate system natural to the organism.

IV. Parallelism of Lines

In the definition of order, given by Sickles and Hartmann (10), there are three geometric terms, *viz.*, straight lines, the vertico-horizontal reference system, and parallelism of lines. Only the last of these, parallelism, remains to be discussed.

Parallels may be defined by the following theorem: *two or more lines, separate in existence, yet having the same direction, are said to be parallel.* Mach came to the conclusion that parallels were fundamental elements of space-perception through his investigation of symmetry—a special type of order. Of all possible groupings of lines, parallels possess the greatest directional simplicity. To Mach, this was an important point, for he felt that space-sensations yield us information concerning the direction of lines, and directional sim-

plicity would therefore make for economy of effort. For this reason also, it would not be out of keeping with the views of Foley, Purdy, or Musatti.

Parallel lines or concentric curves never meet. As a matter of fact, in projective geometry, parallel lines *are* concentric curves. However, a more important property of parallels—as regards the problem of form—is given with the theorem that: *parallel lines form equal angles with all transversals and divide these transversals in the same ratio.* Just as in an electromagnetic field, where symmetrically equivalent positions possess identical intensity values, and lines between them form equal angles with the axes of the field, so do parallel lines form equal angles with their transversals and divide these proportionately. This fact, it is to be noted, makes for *even repetition of even units, which is just another way of saying order* (10). In the theory of order, it was stated that the sensation of orderliness came about as a result of the relative directions of new intervals created by the act of combination, these newly created intervals being *also parallel.* Thus, in a sense, it might be said that parallels propagate themselves, *i.e., produce like kind*—a rudimentary geometrico-dynamic function which seems indicative of the principle most unique to living matter.

Just as in the case of the cartesion coordinate system, parallels also have a property which is particularly unique to electromagnetism, namely, when two currents traveling the same direction are placed *parallel* to each other, their individual fields possess opposite signs. From this property it can be deduced that *parallel currents attract each other.* A magnetic force of $2c/m$ is produced by a straight current at a distance m. When another straight current c' is placed close and parallel to the first, the force produced on a length l can be expressed by $2cc'l/m$. Since this force acts perpendicularly to both the induction and the current, it attracts two currents when they move in the same direction.

Why so much discussion of simple bits of physics and geometry such as these facts of perpendicularity and parallelism? Merely this: that these action-laws, so unique to electromagnetic fields, appear also to be laws of perceptual activity. *It is the contention of the theory of order, that this electromagnetic attraction between parallels is the mortar that holds the visual field together.* It accounts for all organization, coherence, constancy, unity, and distortion in visual perception. It is, in a word, *order.*

If a handful of small objects is scattered on top of a table, and studied, the chances are that the arrangement of no one thing or group of things will arrest the attention. As soon, however, as a few of the units are rearranged so that subjectively parallel intervals are formed relative to the vertico-horizontal coordinate system, order immediately appears.

In Fig. 1, we have a pin, key, and button which have no intra-parallelism as a group, *i.e.,* there is no *order* in their arrangement. Thus, they are not associated mentally. Figure 1 is composed of three individual objects, and there is no sensation of their 'somehow being related.' The lines which have been drawn through their directions of structural prominence merely denote the lack of intra-parallelism or relation to any coördinates.

In Fig. 2, these same three objects have been rearranged relative to each other and the optically preferred vertico-horizontal coördinate system. A glance at this figure reveals that they now have association value, or *order.* Instead of being merely three individual and unrelated objects, they have be-

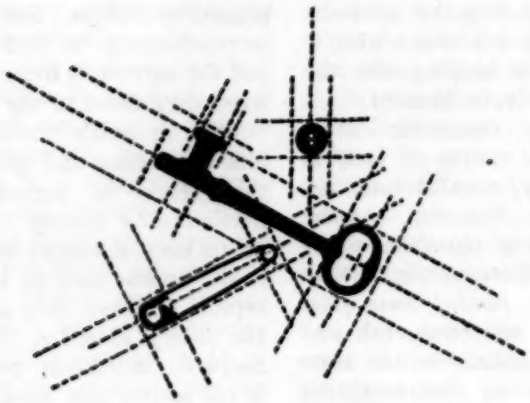

FIG. 1. A collection of three objects without order—the subjective intervals lacking intra-parallelism

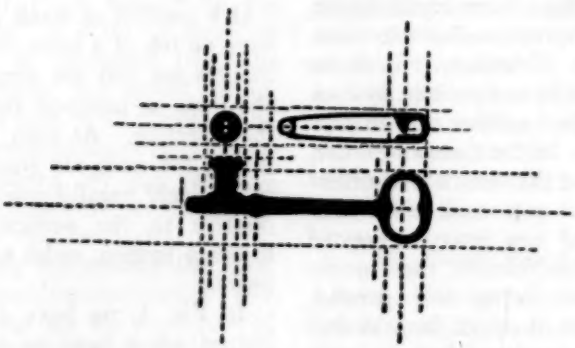

FIG. 2. A group of three objects having order—as demonstrated by their intra-parallelism

come perceptually welded into a whole, an orderly group. We seem to sense that, somehow, they 'belong together.'

Though utterly unrelated by meaning or function, these items will stand out together as a whole—they will have coherence born of an interrelationship subjectively provided by the observer. They will seem to 'belong together.' Due to the relative rearrangement, certain prominent structural points and directions fall within the same coordinate system and therefore receive the same positional emphasis. By the same token, they gain a directional simplicity and seem associated. Lines drawn between them reveal a marked parallelism.

Relative structural direction-differences alone, therefore, can account for this contrast between these two figures. No matter what sort of context in which we might place the orderly group, as long as there was enough color-difference to make the objects perceptible, their inter-connectedness would be sensed. If this context were composed of similar objects, all those which fell parallel with the directions of the group would be included into the group pat-

tern. On the other hand, these facts concerning Fig. 2 would not hold true for Fig. 1. If Fig. 1 were placed in a context of similar objects, it would immediately lose its identity as a 'group.' It would be split up by the slightest parallelism with any object of the bordering context. Only the homogeneity of the present background gives it existence as a sensory whole. Thus, we realize that these geometric factors of perpendicularity and parallelism account not only for the coherence of Gestalten—but also assist in their segregation from their contexts.

A contrast of Figs. 1 and 2 provides glaring evidence that perceptual order is an electromagnetic phenomenon—just as Sickles (9) found that the distortion in visual illusions was to be similarly explained. If, in the perceptual images, the contours of these objects were represented by electrical action of the same directions, then the resulting field given by Fig. 1 would have little or no coherence, and the inter-attraction would be discordant, whereas that of Fig. 2 would be highly coherent, unified, and the inter-attraction would be constant. Thus, *any visual field wherein the objects are arranged so that an identically structured electromagnetic field would demonstrate a high degree of coherence and unity—that visual field is said to possess order.* Consequently, if a handful of small objects were arranged in a complete circle on a homogeneous background, they would also possess a highly unified field, and therefore order. However, the eyes never see curves save when these are objectively present—all subjective intervals being straight lines —by necessity of the action-laws of electromagnetism.

V. SUMMARY

Geometric properties of electrical fields	*Geometric properties of psychological processes*
	All spatial judgments have directional constancy. The straight line is the only line with complete directional constancy.
	The straight line is the mean of the depth sensations of the neighboring points.
	The organism developed in a symmetrical fashion. The straight line is the only division of an area which can result in symmetry.
Like all forces, electricity selects the path of least resistance through a constant medium—*a straight line.*	The earliest type of organized behavior is the tropism, a blind reaction to straight line forces (sunlight and gravity) and depending on the symmetry of the animal.
	The objects of the visual field have tri-dimensional positional constancy. Because the straight line is the only unidimensional form, it is the only basic unit with which definite relative position can be obtained in any direction in any plane.
	Order, as defined by Sickles and Hartmann, depends upon directional simplicity. A straight line has the maximum of simplicity—zero curvature.
	Mach's *Analysis* reveals the basic importance of the straight line with regard to space-sensations as a whole.

Geometric properties of electrical fields	*Geometric properties of psychological processes*
	Perpendiculars are also straight lines—and all data pertinent to straight lines are therefore pertinent to perpendiculars.
	The organism is a symmetrical result of symmetrical evolution; the perpendicular is the mean of symmetry.
	Judgments of movement are most accurate with reference to the perpendicular.
	The visual field is so organized that it demonstrates a directional constancy for all its many points; such constancy can be relative only to a reference system.
The electric current is the only uni-dimensional force which automatically creates a tri-dimensional field of tension. This field is set up perpendicular to the current, and acts in directions perpendicular to its diameters. Thus, *the electromagnetic field is an active reference system.*	The human eye reveals a 'plus-sign phenomenon,' giving direct experience of the vertico-horizontal reference system.
	Illusions of reversible perspective (such as the cube) reveal, upon analysis, two complete and objectively present reference systems.
	Illusions of incomplete perspective (such as the Zoellner illusion) reveal a distortion of the judged lines that is perpendicular to the directions of the system wherein the 'field lines' occur.
	Order, as defined in the theory of order, necessitates a reference system.
	Mach demonstrated that the optical identity of figures geometrically congruent necessitates their being judged relative to the same reference system.
	Koffka, Purdy, James, and others, gave experimental evidence for the existence of a frame of reference.
	Parallels are also straight lines, and all data pertinent to straight lines are therefore pertinent to parallels.
	Parallels form equal angles with all transversals and divide these in the same ratio. This brings about even repetition of identical designs—which is just another way of saying *order*.
Electricity is the only force where two vectors moving in the same direction, *i.e., parallel,* reveal an attraction for each other.	Parallel grouping of lines is the grouping having the maximum directional simplicity, therefore involving the greatest economy of effort. The visual field demonstrates a preference for Gestalten having directional simplicity. This agrees with the work of Foley, Purdy, and Musatti.
	Parallelism of lines in the visual field lends coherence and unity to this field.
	Mach's experiments in the identification of symmetrical figures led him to the conviction of the basic nature of parallels.
The electromagnetic field is tri-dimensional and unified, yet it is created, shifted, or destroyed almost instantaneously merely by altering the uni-dimensional determinant—the electric current. All spatial changes are complete, and readjustment includes all parts of the field at the same time.	Figures of reversible perspective alter perspective, from system to system, almost instantly, regardless of the complexity of the field. The same is true of illusions of figure-ground and movement.
	The visual field is a highly complex and organized structure, and though it involves staccato stimulation from countless points, is tri-dimensional. Yet, despite this complexity, a shift of the eyes sets up or destroys a field without a break in the continuity.
All points of identical intensity in the electromagnetic field have positions symmetrical to the axes of the field.	The component points of the visual field have positional value and identity relative to their direction and distance from the center of attention.
	The progressive difference of intensity identity of all points symmetrical to the third axis of a reference system, is the simplest possible explanation of perspective.

Geometric properties of electrical fields

Electrical charges are distributed according to shape, and this ratio of distribution is not altered by altering the size of the body in question.

Geometric properties of psychological processes

According to Mach's experiments, wherefrom Ehrenfels drew his second criterion for phenomenal configurations, shape is remembered, rather than size. A child can recognize an elephant though he never saw anything but a small miniature of the animal.

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MOSHE BRILL

1910–1943

The Hebrew University has been bereaved of one of its youngest scholars. Though Dr. Moshe Brill was only thirty-three years old when he died, he had already made a notable place for himself in the fields of psychology and education. The achievements of his short life were so numerous that it seemed as though he had reason to make haste. Though he did indeed suspect that this was so, he did not spare himself and conserve his strength; disregarding the pleas of his physicians and friends, he worked all the harder to complete the tasks he had set himself. His associate, Dr. Rieger, said truly at the graveside that he had lived the hurried life of a man who knew himself doomed to an early death.

Dr. Brill was a teacher, a psychologist, and a scientific educationalist. Born in Safed, he attended the Misrachi Teachers College of Jerusalem and contined his education at New York University, from which he held three degrees. As a graduate student he held a post in the Psycho-Educational Clinic of New York University.

Dr. Brill was on the staff of the Education Department of the Hebrew University, Jerusalem, since the Department was organized in 1936. His many-sided activities were focused upon three major aims:

He was deeply concerned with underprivileged children suffering from natural or social handicaps. Hence his studies on children who are hard of hearing, the waifs and strays of Jerusalem, juvenile delinquents, child refugees (the "Teheran children"), and other categories of underprivileged children.

His preoccupation with the "laws of learning" and their application in the scientific analysis of the laws of teaching in general and in specific subjects led him to make studies on retardation of pupils and the causes of that condition; on the results of instruction in arithmetic in certain grades; and on facilitating the teaching of the Arabic language by determining the basic words which occur most frequently in daily usage and which are most needed by the student. In connection with the teaching of Arabic, Dr. Brill left behind him not only his book on *Basic Arabic, a basic word list of the Arabic daily newspapers,* but also a comprehensive work which he compiled with the aid of two younger scholars and which will be published in the near future.

Dr. Brill's third major concern was with the pedagogical and psychological training of teachers in Palestine, for whom it is difficult to keep up with the latest developments in their profession. For this purpose he wrote a series of introductory pamphlets on various scientific subjects, such as psychological and educational statistics and educational psychology, and also a book on psychoanalysis. Furthermore he translated Flügel's well-known *One hundred years of psychology* into Hebrew.

In all his activities Dr. Brill constantly kept the needs of living human beings—the underprivileged child, the pupil in the classroom, the teacher seeking to improve his professional knowledge—before his mind's eye. He was full of life, radiating vitality; but it was not granted him to live out his life in its fullness. Life and death met at the moment of his passing; he had greeted his second daughter, who was two days old when he died.

Moshe Brill's many books, his kindred, associates and students will keep his name and his memory alive.

E. SIMON

Hebrew University, Jerusalem

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